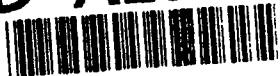


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SYSTEMS

N-v-M
PROTOTYPE TRAINER
Requirements Analysis
Report

March 12, 1989

Prepared for
Naval Training Systems Center
Orlando, FL 32826

Prepared by
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SECTION I

INTRODUCTION

1. OBJECTIVES

The objectives of this analysis are to: (a) identify the critical pilot HOTAS tasks and skills which need to be improved and/or maintained when deployed, (b) define the training requirements for the device that will meet the needs of the fleet, and (c) develop a preliminary specification that functionally defines the trainer and its capabilities.

2. BACKGROUND

The F/A-18 aircraft was designed with a Hands on Throttle and Stick (HOTAS) system to allow the pilot to control a wide variety of weapons, sensors and displays during critical mission phases while still maintaining flight control of the aircraft. In other words, the HOTAS concept enables the pilot to keep his hands on the power and flight controls and still perform his mission operations effectively.

The HOTAS system consists of seven controls on the flight control stick and nine controls on the throttles. These controls can be used in an almost infinite variety of combinations depending on the mode of operation in which the aircraft is configured, i.e. Navigation, Air-to-Air or Air-to-Ground. The manipulation of the HOTAS controls provides a vast array of information to the pilot on the left and right Digital Display Indicators (DDI), Horizontal Indicator (HI) and Head Up Display (HUD). Based on the pilot's interpretation of this displayed information, offensive weapon delivery and defensive electronic countermeasures (ECM) are then taken by further manipulation of the HOTAS controls.

To achieve the high level of pilot skill necessary to use the HOTAS system efficiently, extensive training and practice is required. Initial training in the operational use of the HOTAS is accomplished at the Fleet Readiness Squadron (FRS) in land based training devices such as the 15C13 HOTAS Part Task Trainer (PTT), the 2F132 F/A-18 Operational Flight Trainer (OFT), and the 2E7 Weapons Tactics Trainer (WTT). Once the pilot graduates from the FRS and is assigned to an operational squadron, he must maintain his HOTAS skills through operational

flights and, whenever possible, through the use of trainers located at centralized state-side bases. Once the pilot's squadron deploys to a remote location, however, the means to practice many of the most critical HOTAS skills are no longer available.

3. THE PROBLEM

The non-availability of means to maintain, and perhaps improve HOTAS skills as discussed above, has established a valid need for a deployable, shipboard trainer that can provide continuing HOTAS training during remote operational assignments. As can be seen in the preceding paragraphs, the HOTAS system requires complex perceptual, psychomotor, information processing, and decision making skills to enable the F/A-18 pilot to perform his mission effectively in an operational environment. These skills can only be maintained and improved with practice on a continuing basis.

The problem at issue in this study is to define a deployable HOTAS trainer that will meet HOTAS system training requirements and constraints in a manner that is educationally sound and in a configuration that is acceptable to the fleet. Inherent in a shipboard, deployable trainer are all the built-in constraints associated with mobility, lack of space, harsh operating environment, and limited maintenance and logistics support. Other requirements cited in the Statement of Work (SOW) are that the trainer will be used without an instructor and must, therefore, have the capability to allow the user to set conditions and initialize his practice mission, measure his performance and then provide him feedback on his performance. These constraints and requirements indicate the need for an extremely sophisticated, highly automated training device.

SECTION II

SYSTEM DESCRIPTION

The F/A-18 has three master modes of operation: Navigation (NAV), Air-to-Air (A/A), and Air-to-Ground A/G. The HOTAS controls (see Figure 1) are an integral part of the successful operation of the aircraft in any of the master modes in effect during the accomplishment of a mission. The HOTAS controls consist of 16 switches; seven on the flight control stick and nine on the throttle. Many of the switches have different functions depending on the master mode in effect at any given time. A brief description of the HOTAS controls follows.

1. THROTTLE CONTROLS

- a. Communications Switch - Three position rocker switch. Initiates transmissions on Channels 1 or 2.
- b. Flare/Chaff Dispenser Switch - Three position momentary switch. Releases chaff or flares.
- c. Cage/Uncage Switch - Momentary pushbutton switch. In the A/A master mode, it cages or uncages the Sidewinder missile and gun sight reticle as follows:
 - (1) Sidewinder Missile Mode:

First activation - Cage setting commands the Sidewinder (AIM-9) seeker head to align itself to the aircraft boresight axis.

Second Activation - Uncage setting commands the Sidewinder seeker head to align itself with the scanning pattern of the radar line of sight.
 - (2) Gun Mode:

First Activation - Changes fixed range of 2,000 feet to 1,000, feet with a 25 milliradian diameter stadiometric reticle displayed on the HUD.

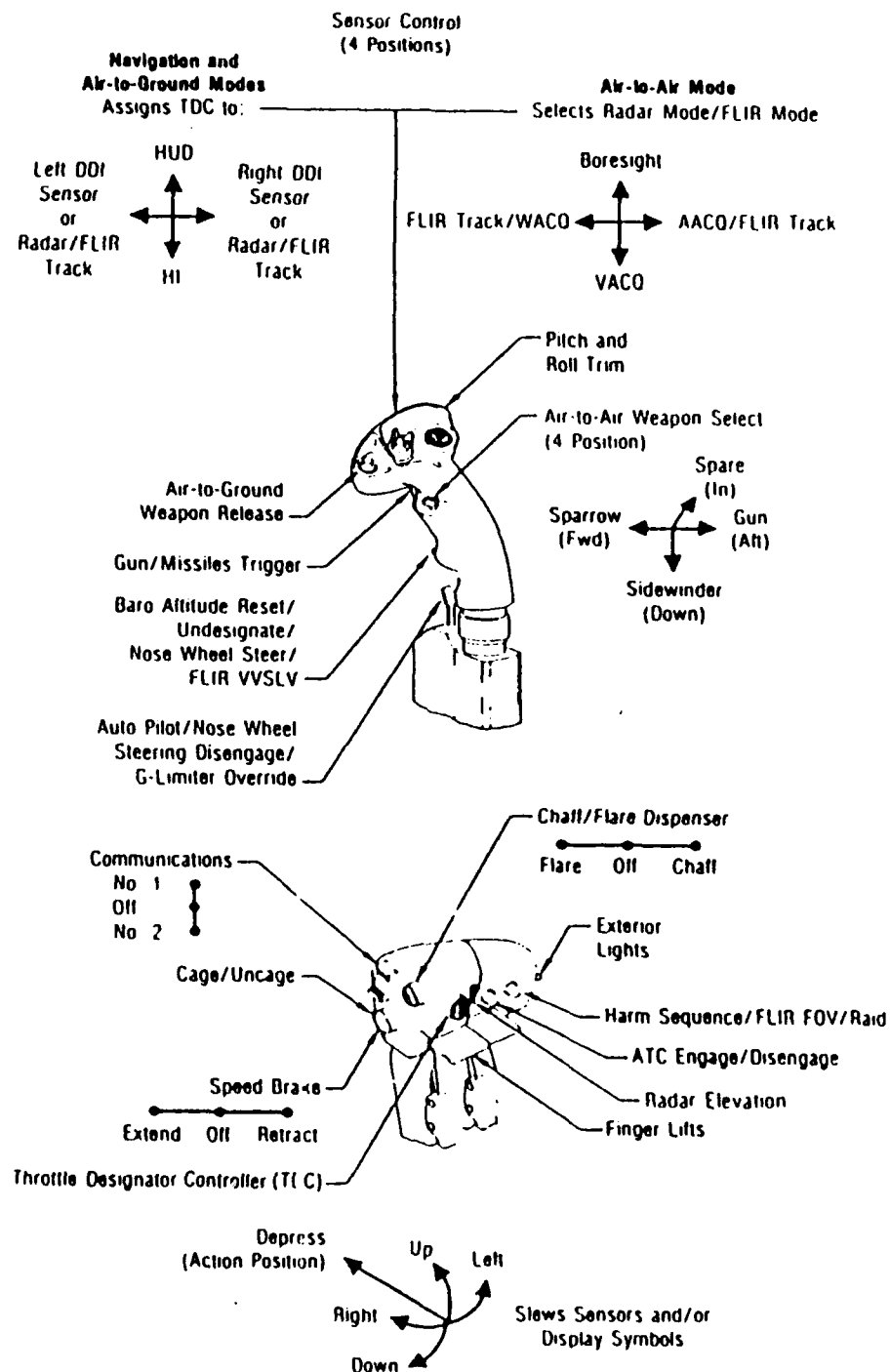


FIGURE 1 - Flight Control Stick and Throttle Switches

Second Activation - Changes range back to a fixed setting of 2,000 feet with a 12.5 milliradian diameter stadiometric reticle displayed on the HUD.

In the A/G master mode, the Cage/Uncage switch performs essentially the same functions for the Maverick and Walleye missiles and the gun as it does in the A/A mode for the AIM-9 and the gun. When in the HARM Target of Opportunity (TOO) mode, depressing the switch hands off target data to the HARM selected for firing. With a SHRIKE missile aboard, switch activation commands angle gate enable/disable. (Angle gate enable reduces the radar acquisition window but increases reflectivity in order to better discriminate among and select targets.) Finally, in the NAV master mode, the velocity vector symbol on the HUD may be caged by activation of the switch in which case flight path/pitch ladder and steering information will be displayed near the center of the HUD.

- d. Speed Brake Switch - Three position slide switch. Extends or retracts the speed brake:

Extend (aft position) - Extends speed brake.

Off (center position) - Inactivates speed brake.

Retract (forward position) - retracts speed brake.
- e. Throttle Designator Control (TDC) - Four way force transducer with push button switch. Provides x and y outputs for the display cursor and/or sensor control. The push button is used for target designation and sensor control functions.
- f. Automatic Throttle Control (ATC) Switch - Momentary pushbutton switch interfaced with the Flight Control System (FCS). Alternate depressions of the switch engage or disengage the automatic throttle control. When the ATC is engaged while in the landing configuration, the FCS adjusts power to maintain constant AOA. When the ATC is engaged while not in the landing configuration, the FCS adjusts power to maintain constant true air speed.
- g. HARM Sequence/FLIR FOV/Raid Switch - Momentary pushbutton switch interfaced with the Stores Management Set. Operation is as follows:

- (1) HARM Sequence - In all master modes, when HARM is in the Self-Protect Pullback and A/G modes, and when HARM is in the TOO or Self Protect mode, depressing and releasing the pushbutton sequences through available targets. In the Self Protect mode, the sequence is from the highest to the lowest priority target. In the A/G and NAV modes, with HARM in the TOO monitor mode (HARM not the selected weapon), the TDC must be assigned to the HARM format for the HARM sequence to operate.
 - (2) FLIR FOV - In the A/G and NAV modes, when the FLIR is in operation and the switch is not dedicated to HARM, depressing and releasing the button toggles the field of view (FOV) between wide and narrow.
 - (3) RAID - In the A/A mode (and in the NAV mode when the TDC is assigned to the A/A radar) with the radar operating in Single Target Track (STT), or Track While Scan (TWS), and HARM is not in Self Protect Pullback, depressing and releasing the pushbutton commands the radar from STT or TWS to the RAID mode. Depressing and releasing it again commands the radar to STT.
- h. Exterior Light Switch - Two position switch. Turns exterior lights on and off
- i. Radar Elevation Switch - Potentiometer. Raises and lowers radar antenna's spatial coverage.

2. FLIGHT CONTROL STICK CONTROLS

- a. A/G Weapon Release Switch - Momentary pushbutton switch. Commands weapon release and, if the Video Tape Recording System (VTRS) is on board and activated via the Camera Video Tape Panel controls, the HUD imagery or raster video from the left or right DDI and the headset audio will be recorded.
- b. A/A Weapon Release Switch - Four position toggle and pushbutton switch. Selects A/A weapons (Sparrow, Sidewinder or gun) and places the Weapon System in the A/A master mode.
- c. Gun/Missile Trigger Switch - Two detent switch. Fires gun and Sparrow and Sidewinder missiles.

- d. Sensor Control Switch - Four position momentary switch. Function depends on which of its two modes of operation (NAV-A/G and A/A) are in effect. Functions include assigning TDC priority to sensors and weapons; assigning the TDC to the HUD and the HI; placing the radar in various modes of operation; and commanding FLIR to track or break track.
- e. Trim Switch - Four position momentary switch. Adjusts aircraft pitch and roll trim.
- f. Undesignate/Nose Wheel Steering Switch - Momentary pushbutton switch. Undesignates all designated targets; commands radar and FLIR to break lock if tracking targets; changes radar modes; and engages nose wheel steering in weight-on-wheels condition.
- g. Autopilot/NWS Disengage Switch - Momentary paddle switch. In weight-on-wheels state (aircraft on the ground), it disengages the autopilot or overrides G-limiter. In weight-off-wheels condition (aircraft in flight), it disengages nose wheel steering.

SECTION III

TECHNICAL APPROACH

1. OVERVIEW

This report summarizes the results of two of the three major tasks involved in developing a functional specification for a deployable HOTAS trainer. A brief outline of project tasks is as follows:

I. Develop task listing

- A. Collect and Review HOTAS Documentation
- B. Develop Trainer Task Listing
- C. Prepare Task Listing Report

II. Identify trainer requirements

- A. Administer HOTAS Questionnaire
- B. Develop Trainer Task Description Matrix
- C. Identify Trainer Requirements
- D. Prepare Requirements Analysis Report

III. Prepare Deployable HOTAS Trainer Functional Specification

This report marks the completion of the second phase of the analysis. The remainder of the effort will be devoted to the preparation of the Functional Specification. A more detailed discussion of the tasks accomplished thus far is presented below.

2. DEVELOP TASK LISTING

a. Collect and Review HOTAS Documentation

In order to identify and define the requirements for the deployable HOTAS trainer, as many appropriate F/A-18 documents as possible were collected for review. Included were NATOPS and flight manuals, military characteristics reports and engineering specifications for similar, existing devices, and various HOTAS study and MCAIR system reports. A complete list of the documents reviewed can be found in the bibliography located at the end of this report.

The available F/A-18 HOTAS data was reviewed to identify the functions performed by the HOTAS controls and their relationship with the cockpit displays. It was found that the controls perform a multiplicity of functions and that the functions vary depending on which master mode (A/A, A/G, NAV) is in operation. This data was analyzed and used as the basis for developing the task listing and trainer requirements data.

b. Develop Trainer Task Listing

Although many of the documents discussed above provided usable information for the development of the trainer task listing, the primary resource for this task was the current issue of the "Objectives Hierarchy Report" developed for the F/A-18 Instructional System Development program being used at the three F/A-18 training squadrons. Since the HOTAS System was the object of the analysis, the effort was limited to identifying only those tasks associated with the three primary phases of a tactical mission i.e. air-to-air, air-to-ground, and tactical defense; routine flight and housekeeping operations were not considered.

An overall listing of all HOTAS tasks performed in the three master modes was compiled. This task listing represents an overall description of the pilot's job on a tactical mission. Based on the documentation available and preliminary analysis of data from a questionnaire administered to fleet personnel, (see below), those tasks with a comparative low priority were identified for possible future elimination from further consideration as tasks for training on a deployable HOTAS trainer.

c. Prepare Task Listing Report

The task listing discussed above was integrated into a formal report which was submitted as a deliverable to NTSC.

3. IDENTIFY TRAINER REQUIREMENTS

a. Administer HOTAS Questionnaire

The basic approach taken to determine the capabilities and functions that should be incorporated into the HOTAS deployable trainer was to survey the potential fleet users of the device in order to obtain their expert judgments. The objective of the survey was to determine what features should be included in the trainer to enable fleet personnel to maintain their HOTAS skills while deployed. A questionnaire was developed through a combined effort by NTSC and EER Systems, which concentrated on the complexity,

difficulty, criticality, and frequency of pilot tasks requiring the use of the seven control stick and nine throttle switches of the HOTAS while under the various master modes of tactical operation. A draft of the questionnaire was sent to the F/A-18 Fleet Project Team (FPT) for review and comment. Following receipt of FPT comments, the questionnaire was modified to accommodate FPT recommendations and prepared for administration. A copy of the questionnaire is presented in Appendix A.

The questionnaire was administered at two locations: NAS Lemoore and NAS Cecil Field. Unforeseen circumstances at NAS Lemoore resulted in an extremely small sample of only four pilots to fill out the questionnaire. Following completion of the questionnaires, an informal discussion was held with the pilots to pick up any additional requirements that might be appropriate. The same procedure was followed at Cecil Field where an additional 16 questionnaires were completed for a total of 20. While this was not as large a sample population as was desired, the consistency of responses was sufficiently high to indicate valid data. A summary of response data can be found in Appendix B.

b. Develop a Trainer Task Description Matrix

The Trainer Task Description Matrix was developed to provide additional information for the identification of the training capabilities requirements for the HOTAS Deployable Trainer. The approach used in the development of the matrix was to take the task listing previously completed, add a number of subtasks gleaned from documentation not available previously, and assign to each task/subtask, the conditions under which it would be performed. The cockpit controls, displays and indicators required to accomplish each task were then identified and added to the matrix as were the simulation requirements for each task or group of tasks. The final item in the matrix is a level of priority (three tier) for incorporating the simulation requirements into the trainer. The priorities were assigned on the basis of the information found in the reference documentation, and in the questionnaire and interview data obtained from the F/A-18 pilots. The Trainer Task Description Matrix, together with the HOTAS Task Questionnaire data, will provide the basic data for preparation of the HOTAS Deployable Trainer Preliminary Functional Specification. The Trainer Task Description Matrix is presented in Appendix C

c. Identify HOTAS Trainer Requirements

The responses to the questionnaires were combined into simple means, totals and percentages and summarized as presented in Appendix B. This summary data was analyzed and integrated with the information resulting from the informal discussions held with F/A-18 pilots and with the data tabulated on the Trainer Task Description Matrix. This analysis resulted in a set of prioritized requirements for the functions, controls and displays that should be incorporated into a deployable HOTAS trainer. They will provide the basis for developing the final deliverable of this project i.e. the functional specification for the deployable HOTAS trainer. The requirements are cited in the Recommendations and Conclusions section of this report.

d. Prepare the Requirements Analysis Report

This task was directed to the preparation of this Requirements Analysis Report which is submitted as a contract deliverable.

4. PREPARE DEPLOYABLE HOTAS TRAINER FUNCTIONAL SPECIFICATION

This effort will be the final deliverable of CDRL Item A003 of the N-v-M contract. When completed, it will provide a functional description of a deployable HOTAS trainer in sufficient detail to enable engineering personnel to use it as the basis for developing a detailed engineering specification for the device. As stated above, the functional description will be based on the requirements data developed during the earlier phases of this task.

SECTION IV

FINDINGS

This section presents the findings that resulted from the administration of the HOTAS Task Questionnaire shown in Appendix A. These findings are based on the responses of the pilots who completed the questionnaire as summarized in the data shown in Appendix B, Parts II and III. All responses are listed in rank order according to the responses. The percentages cited reflect the number of pilots responding to a specific item versus the total number of pilots surveyed.

1. Of the three Master Modes, the Air-to-Air Mode is considered the most difficult (53%) and complex (65%) to operate. The Air-to-Ground Mode is considered somewhat less difficult (42%) and complex (35%) while the Navigation Mode is considered neither difficult (5%) nor complex (0%) to operate. (Questions 1 and 2)
2. The HOTAS controls which are considered the most important (Question 3):

| <u>Throttle</u> | | <u>Control Stick</u> | |
|-----------------------------|-----|--------------------------|-----|
| Throttle Designator Cont. | 90% | A/A Weapon Select Switch | 70% |
| Radar Elevation Switch | 30% | Sensor Control Switch | 50% |
| HARM Seq./FLIR FOV/Raid Sw. | 20% | Gun/Missiles Trigger | 40% |
| Chaff/Flare Dispenser Sw. | 20% | A/G Weapon Release Sw. | 25% |

3. The HOTAS controls which require the most practice to maintain proficiency (Question 4):

| <u>Throttle</u> | | <u>Control Stick</u> | |
|-----------------------------|-----|--------------------------|-----|
| Throttle Designator Cont. | 90% | Sensor Control Switch | 70% |
| Radar Elevation Switch | 65% | A/A Weapon Select Switch | 50% |
| Chaff/Flare Dispenser Sw. | 45% | | |
| HARM Seq./FLIR FOV/Raid Sw. | 30% | | |
| Cage/Uncage Switch | 25% | | |

4. The HOTAS controls which are the most difficult to set up correctly (Question 5)

AIR-TO-AIR MODE

| <u>Throttle</u> | | <u>Control Switch</u> | |
|-----------------------------|-----|-----------------------|-----|
| Throttle Designator Cont. | 72% | Sensor Control Switch | 39% |
| Radar Elevation Switch | 55% | A/A Weapon Select Sw. | 22% |
| Chaff/Flare Dispenser Sw. | 33% | Gun/Missile Switch | 11% |
| HARM Seq./FLIR FOV/Raid Sw. | 17% | | |
| Cage/Uncage Switch | 22% | | |

AIR-TO-GROUND MODE

| <u>Throttle</u> | | <u>Control Stick</u> | |
|-----------------------------|-----|-----------------------|-----|
| HARM Seq./FLIR FOV/Raid Sw. | 67% | Sensor Control Switch | 39% |
| Throttle Designator Cont. | 61% | A/G Weap. Rel. Switch | 17% |
| Chaff/Flare Dispenser Sw. | 28% | Gun/Missile Trigger | 5% |
| Radar Elevation Switch | 17% | | |
| Cage/Uncage Switch | 11% | | |

5. The responses to questions 6 through 12 of the questionnaire were consistent with the responses shown above and provided reinforcement to their validity. A breakdown of specific response data for these items can be found in Appendix B.
6. In an EW environment, the Chaff/Flare Dispenser Switch is considered the most critical control and the Radar Warning Receiver (RWR/ALR-67) with the HUD are considered the most critical displays (Question 13). Complete data for these and less critical controls and displays is shown in Appendix B.
7. The frequency of use of the Air-to-Air Radar Modes (Question 14):

Always Used

| | |
|--|-----|
| Range While Search (RWS) | 85% |
| Single Target Track (STT) | 85% |
| Non-Cooperative Target Recognition (NCTR) | 60% |
| Electronic Counter-Counter Measures (ECCM) | 50% |
| Auto Acquisition (AACQ) | 50% |

Sometimes Used

| | |
|-----------------------------|-----|
| Track While Scan (TWS) | 75% |
| Vertical Acquisition (VACQ) | 65% |
| Gun Acquisition (GACQ) | 65% |
| Raid | 50% |

Rarely Used

Velocity Search (VS) 85%

8. The frequency of use of FLIR when integrated with the Air-to-Air radar modes (Question 15). Note: Four of the pilot responders indicated that they had never used FLIR so the percentages cited reflect only the responses of the 16 pilots with FLIR experience.

Always Used

Velocity Vector Slaved (VVSLV) 50%
Radar LOS Slaved (RRSLV) 50%
FLIR Autotrack 44%

Sometimes Used

Velocity Vector Slaved (VVSLV) 50%
Radar LOS Slaved (RRSLV) 50%
FLIR Autotrack 50%

Rarely Used

Inertial LOS Slaved 69%
Radar Offset LOS Slaved 56%

9. The frequency of use of the Air-to-Ground Radar Modes (Question 16):

Always Used

Doppler Beam Sharpened Patch (EXP2) 65%
Air-to-Ground Ranging (AGR) 65%
Real Beam Ground Map (MAP) 50%

Sometimes Used

Ground Moving Target (GMT) 60%
Sea Surface Search (SEA) 53%
Doppler Beam Sharpened Sector (EXP1) 50%
Medium Resolution Synthetic Aperture (EXP3) 50%

Rarely Used

Terrain Avoidance (TA) 95%
Precision Velocity Update (PVU) 55%

10. Pilot skills most likely to deteriorate with lack of practice (Question 17):

| | |
|---|-----|
| Throttle Designator Control operations | 50% |
| A/A, A/G and general FLIR operations | 45% |
| A/A targeting, radar setups | 40% |
| HARM/SHRIKE/WALLEYE delivery | 35% |
| Use of the Radar Elevation Switch | 30% |
| Use of the Weapon Select Switch | 20% |
| Use of the Chaff/Flare Dispenser Switch | 20% |

11. The capabilities that should be required of a deployable HOTAS trainer (Question 18):

| | |
|--|-----|
| HARM/WALLEYE delivery | 70% |
| A/A targeting/radar sorting | 40% |
| A/A missions against all types of bogeys | 35% |
| FLIR sequences | 25% |
| A/G weapons sequences/maneuvers | 25% |

SECTION V

CONCLUSIONS

The following conclusions and supporting rationale, relative to the development of a deployable HOTAS trainer, were drawn following review and analysis of the information extracted from relevant F/A-18 documentation, pilot interviews, HOTAS Task Questionnaires, and the Trainer Task Description Matrix.

1. GENERAL

- a. Flight characteristics of the HOTAS deployable trainer should simulate the F/A-18C aircraft to the highest degree possible.
- b. Suitable scenarios will be required for both Air-to-Air and Air-to-Ground Master Mode simulation. Training in Air-to-air tactics, both offensive and defensive, is considered the most important requirement for simulation followed closely by offensive and defensive Air-to-ground tactics.
- c. Requirements for simulated gaming areas should include:
 - (1) Air-to-Air visual and radar environments which include varying types and numbers of adversary aircraft as well as incoming enemy heat-seeking and radar guided missiles.
 - (2) Air-to-Ground visual and radar geographical areas which include various tactical targets as well as active emitting and/or shooting AAA and SAM sites.
- d. FLIR operation should be considered a high priority function to be simulated since fleet pilots get very little opportunity to practice its use. While FLIR is used primarily for day or night detection in the A/G Mode, it also has limited application in the A/A Mode which pilots expressed a need to have simulated.

- e. Mixed scenarios that require the pilot to make rapid change-overs between Master Modes must be included in the software for the HOTAS trainer to provide the realistic simulation of actual combat situations. During the performance of many missions, the pilot may be required to make such mode changes to accommodate to changing tactical situations. For example, while flying an A/G mission in the A/G Mode, the pilot might encounter hostile aircraft. This will require an immediate switch to the A/A Mode to engage the threat, after which a switch back to the A/G Mode must be made for weapons delivery on the ground target.
- f. The following HOTAS controls should be functionally simulated for the F/A-18 A/A and A/G Master Modes

| <u>Throttle</u> | <u>Control Stick</u> |
|------------------------------------|-----------------------|
| Throttle Designator Control Switch | A/A Weapon Select |
| Radar Elevation Switch | Sensor Control Switch |
| HARM Seq./FLIR FOV/Raid Switch | Gun/Missiles Trigger |
| Chaff/Fare Dispenser Switch | A/G Weapon Release |
| Switch | |
| Cage/Uncage Switch | |

The NAV Master Mode is not included above because it was considered neither difficult nor complex by the pilots surveyed and was, therefore, given no priority for simulation.

- g. The following HOTAS controls have insufficient supporting data to justify a requirement that they be functionally active:

| <u>Throttle</u> | <u>Control Stick</u> |
|----------------------------------|-------------------------|
| Communications Switch | Trim Switch (see note) |
| Speed Brake | Baro./Alt./Reset Switch |
| Automatic Throttle Control (ATC) | Auto Pilot/NWS Switch |
| Exterior Lights | |

Note: Addition of a trim switch might be desirable if the fidelity of the F/A-18 flight characteristics is extremely high.

- h. In addition to the required HOTAS controls cited above, the following controls, displays and indicators must be simulated to accomplish the desired training:
- (1) Left and right DDIs with surrounding function pushbuttons
 - (2) ALR-67 Azimuth and Control Indicators
 - (3) Head Up Display (HUD)
 - (4) Horizontal Indicator (HI)
 - (5) Master Arm Panel
 - (6) ECM Control Panel
 - (7) Sensor Control Panel
 - (8) Shoot Cue
 - (9) Selected displays/controls/functions on the Upfront Control Panel
 - (10) Selected displays/controls/functions on the Integrated Fuel/Engine Indicator Panel
 - (11) Related, integrated HUD, Radar, Stores, Format, FLIR, HARM, Navigation, and ALR-67 displays and aural tones.
- i. The Throttle Designator Controller (TDC) is the single most important HOTAS control. It is used to perform a multitude of functions in conjunction with other controls and displays, e.g. select radar modes and parameters, control radar operation, control cursor operation in various DDI displays, etc. The capability to simulate many of these interacting functions should be incorporated in the HOTAS trainer.
- j. In order to include further operational realism into the trainer, the capability to degrade the performance of the HARM, FLIR, ALR-67, and other selected avionics systems should be incorporated into the software. The type and extent of degraded performance should be consistent with the emergency procedures cited in the NATOPS manual and with appropriate maintenance records.
- k. In order to provide performance feedback for self evaluation, one or more of the following performance measures should be included in the HOTAS deployable trainer capabilities:
- (1) A scoring system based on kill, no-kill, and miss distance performance
 - (2) A scoring system based on procedural accuracy
 - (3) Negative scoring for missed opportunities

2. AIR-TO-AIR OPERATIONS

- a. To provide training in long range, (i.e. beyond visual) target acquisition in the Air-to-Air Master Mode, the APG-65 Multipurpose A/A, A/G Terrain Avoidance Radar System needs to be simulated. In the A/A Master Mode, the radar has the capability to operate in approximately 11 separate radar modes. At a minimum, the Range While Search (RWS) and Single Target Track (STT) should be simulated. Non-Cooperative Target Recognition (NCTR) is a sub-mode of the STT radar mode and should also be considered for simulation. Radar simulation is also required to provide pulse doppler illumination for firing the AIM-7 missile. Finally, while of a low priority, the Gun Acquisition (GACQ) mode should be simulated if the Vulcan 20 mm gun is included in the HOTAS trainer's weapons inventory.

3. AIR-TO-GROUND OPERATIONS

- a. As in the case of the Air-to-Air Master Mode, in order to provide long range acquisition of targets in the Air-to-Ground Master Mode, the A/G radar must be simulated. This radar has the capability to operate in nine separate modes, however, only three of these modes seem to be used extensively, i.e. the Real Beam Ground Map (MAP), the Doppler Beam Sharpened Patch (EXP2), and the Air-to-Ground Ranging (AGR) modes. These three radar modes should be simulated.
- b. There is a high priority requirement for simulation of HARM missile delivery as both an offensive and defensive weapon, although it is used primarily as an A/G offensive missile. As is the case with FLIR, fleet pilots get little opportunity to practice delivery techniques for this particular weapon.
- c. As stated above, FLIR should be included as an air-to-ground simulation capability.

4. DEFENSIVE OPERATIONS

- a. There is a high priority requirement for the simulation and integration of defensive tactics into both A/A and A/G missions. Scenarios for defensive operations will be required for both types of mission. This defensive capability will

require an A/A environment that includes both simulated adversary aircraft firing heat-seeking and radar guided missiles as well as incoming AAA and SAM missiles fired from the ground. Also required will be an A/G environment with a variety of tactical targets as well as AAA and SAM sites that emit radar signals and fire weapons at the F/A-18.

- b. To provide a defensive tactics training capability, the Chaff/Flare Dispenser Switch and its related functions will have to be simulated. In addition, there will be a requirement for the ALR-67 Radar Warning Receiver with its associated controls and display indicators.

SECTION VI

RECOMMENDATIONS

FOR THE

GENERIC N-V-M TRAINER

1. Top Priority - Ensure that the air-to-air offensive and defensive tactical capabilities of the generic trainer now being developed are acceptable and can be converted to F/A-18C operations with a minimum of effort when the HOTAS controls are integrated
2. Second priority - Improve the existing N-v-M displays by converting them to representations of actual F/A-18C displays.
3. Third priority - To the extent possible, add an air-to-ground capability to the generic N-V-M trainer.

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ACRONYMS

ACRONYMS

| | |
|-------|--------------------------------------|
| AAA | Anti-Aircraft Artillery |
| AACQ | Auto Acquisition |
| AGR | Air-to-Ground Ranging |
| AOA | Angle of Attack |
| ATC | Automatic Throttle Control |
| CAM | Camera |
| CRT | Cathode Ray Tube |
| DRLMS | Digital Radar Landmark Simulation |
| ECM | Electronic Countermeasures |
| ECCM | Electronic Counter Countermeasures |
| ER/DL | Extended Range/Data Link |
| EXP1 | Doppler Beam Sharpened-Sector |
| EXP2 | Doppler Beam Sharpened-Patch |
| EXP3 | Medium Resolution Synthetic Aperture |
| FCS | Flight Control System |
| FLIR | Forward Looking Infrared |
| FOV | Field-of-View |
| GACQ | Gun Acquisition |
| GMT | Ground Moving Target |
| HARM | High Speed Anti-Radiation Missile |
| HI | Horizontal Indicator |
| HSI | Horizontal Situation Indicator |
| HUD | Head Up Display |
| IMC | Instrument Meteorological Condition |
| INS | Inertial Navigation System |

| | |
|--------------|------------------------------------|
| L-DDI | Left Digital Display Indicator |
| LOS | Line-of-Sight |
| LST | Laser Spot Tracker |
| MAP | Real Beam Map |
| NCTR | Non-Cooperative Target Recognition |
| PB | Pull Back |
| PVU | Precision Velocity Update |
| RAID | Raid Assessment |
| R-DDI | Right Digital Display Indicator |
| RWR | Radar Warning Receiver |
| RWS | Range While Search |
| SAM | Surface to Air Missile |
| SEA | Sea Surface Search |
| SIM/AIRCRAFT | Simulator or Aircraft |
| SMS | Stores Management Set |
| SP | Self Protect |
| STT | Single Target Track |
| SURF | Surface |
| TA | Terrain Avoidance |
| TDC | Throttle Designator Control |
| TOO | Target of Opportunity |
| TWS | Track While Scan |
| UFC | Up Front Control |
| VACQ | Vertical Acquisition |
| VMC | Visual Meteorological Condition |
| VTRS | Video Tape Recording System |
| VVSLV | Velocity Vector Slaved |

APPENDIX A

HOTAS TASK QUESTIONNAIRE

HOTAS TASK QUESTIONNAIRE

Introduction

The Naval Training Systems Center has been tasked to develop a deployable Hands on Throttle and Stick Part Task Trainer (HOTAS PTT) for the F/A-18 aircraft. This system will provide training and proficiency maintenance on those critical HOTAS skills that degrade during lengthy carrier deployments due to lack of practice. This trainer is not being designed to reduce your flight time in the aircraft. It is being developed as a device that will provide training and practice in areas that, for one reason or another, are not available on operational equipment (e.g., EW, HARM).

The first step in the development of the HOTAS PTT is to determine those critical skills that require the most practice to remain proficient in operating the F/A-18 HOTAS system. We request your assistance in providing this information because you are the experts with the F/A-18. You know the required tasks and their criticality. Therefore, we need your input at this early stage of development of the trainer so that it will provide the maximum benefit to you.

There are no right or wrong answers to any of these questions. This is not a test and you are not being evaluated. Your answers will remain strictly confidential. Please take the time to be as accurate as possible.

After we have analyzed this information, we will provide you with a detailed summary report of the results. These results are extremely important as they will help to determine the direction that the HOTAS PTT development will take. We will provide you with regular progress reports, and we hope that you will be able to provide hands on assistance with this trainer in the future. Your cooperation is greatly appreciated. Please call us if you have any questions or comments about this project. Thank you.

NTSC Points of Contact:

Naval Training Systems Center, Code 711
12350 Research Parkway
Orlando, Fl. 32826
ATTN: Dr. David H. Fowlkes or Dr. Patrick J. Moskal

phone: Commercial: (407) 380-4789
Autovon: 960-4789.

BACKGROUND INFORMATION

Please provide the following information:

RANK: _____ DATE: _____

SQUADRON: _____ AGE: _____

Type of aircraft you are currently flying: _____

Approximate total flight hours: _____

Total flight hours by aircraft type:

| Aircraft Type | Hours |
|---------------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

Total flight hours in the last six months:

| Aircraft Type | Hours |
|---------------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

Total simulator hours on the 15C13 (PTT) and 2E7 (WTT):

| Simulator Type | Hours |
|----------------|-------|
| 15C13 | _____ |
| 2E7 | _____ |

HOTAS QUESTIONNAIRE

The following questions are all related to the effective use of the operational F/A-18 HOTAS controls and their associated displays in accomplishing a mission.

1. The F/A-18 HOTAS system has three Master Modes of operation: Air-to-Air (A/A), Air-to-Ground (A/G), and Navigation (NAV). Circle the letter of the mode that causes you to have the greatest difficulty using the HOTAS controls correctly?

- A. A/A mode
- B. NAV mode
- C. A/G mode

2. Circle the letter corresponding to Master Mode that involves the most complex HOTAS operations.

- A. A/A mode
- B. NAV mode
- C. A/G mode

PLEASE REFER TO THIS LIST OF HOTAS CONTROLS AS REQUIRED TO ANSWER THE FOLLOWING QUESTIONS.

HOTAS CONTROLS

- | | |
|---|---|
| A. Chaff/Flare Dispenser | I. Radar Elevation |
| B. Communication | J. Air-to-Air Weapon Select |
| C. Cage/Uncage | K. Pitch and Roll Trim |
| D. Speed Brake | L. Sensor Control (<i>Castle Switch</i>) |
| E. Throttle Designator Controller (TDC) | P. Air-to-Ground Weapon Release |
| F. Automatic Throttle Control (ATC) | Q. Gun/Missile Trigger |
| G. HARM Sequence/FLIR FOV/RAID | R. Barometric Altitude Reset/Undesignate/NWS |
| H. Exterior Lights | S. Autopilot/NWS disengage/G-limiter Override |

3. Please indicate the four HOTAS controls/modes that are the most important by entering the corresponding letters from the list above.

1. _____ 2. _____ 3. _____ 4. _____

4. Please list the four HOTAS controls that require the most practice to be used correctly.

1. _____ 2. _____ 3. _____ 4. _____

5. Please indicate which combination of HOTAS controls and/or modes are the most difficult to correctly set up (e.g., setting up the controls/displays so that you may lock on and fire a Sparrow missile). Do this by entering an X for each affected switch for each mode. Switches which are not used leave blank.

THROTTLES

| | NAV | A/A | A/G | EW |
|--------------------------------------|-----|-----|-----|----|
| 1. Chaff/Flare Dispenser | | | | |
| | | | | |
| 2. Communications | | | | |
| | | | | |
| 3. Cage/Uncage | | | | |
| | | | | |
| 4. Speed Brake | | | | |
| | | | | |
| 5. Throttle Designator Control (TDC) | | | | |
| | | | | |
| 6. Automatic Throttle Control (ATC) | | | | |
| | | | | |
| 7. HARM Sequence/FLIRFOV/RAID | | | | |
| | | | | |
| 8. Exterior Lights | | | | |
| | | | | |
| 9. Radar Elevation | | | | |
| | | | | |

CONTROL STICK

| | NAV | A/A | A/G | EW |
|--|-----|-----|-----|----|
| 1. Air-to-Air Weapon Select | | | | |
| | | | | |
| 2. Pitch and Roll Trim | | | | |
| | | | | |
| 3. Sensor Control | | | | |
| | | | | |
| 4. A/G Weapon Release | | | | |
| | | | | |
| 5. Guns/Missiles Trigger | | | | |
| | | | | |
| 6. Baro Alt. Reset/Undesignate/NWS | | | | |
| | | | | |
| 7. Auto Pilot/NWS Disengage/G-limits Override | | | | |
| | | | | |

8. Exterior Lights

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

Rating Scale

1 2 3 4 5
:-----:-----:-----:-----:-----:
LOW MODERATE HIGH

9. Radar Elevation

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

10. Air-to-Air Weapon Select

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

11. Pitch and Roll Trim

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

12. Sensor Control

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

13. A/G Weapon Release

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

14. Gun/Missile Trigger

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

15. Barometric Altitude Reset/Undesignate/NWS

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

16. Autopilot/NWS Disengage/G-Limiter Override

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

6. Which combination of HOTAS controls do you need to set up the fastest? Under what situation?

7. Once set up, which combination or combinations of HOTAS controls presents the biggest challenge to use correctly?

8. What HOTAS pilot skills are the most likely to deteriorate without practicing?

9. What, if any, situations occur in which the HOTAS controls are commonly set up incorrectly? Please enter the combination of HOTAS controls that may be set up incorrectly?

10. Which of the HOTAS controls require continuing practice to maintain proficiency? Indicate from 1 to 9 for each mode, with "1" requiring the most practice.

THROTTLES

| | NAV | A/A | A/G | EW |
|--------------------------------------|-----|-----|-----|----|
| 1. Chaff/Flare Dispenser | | | | |
| | | | | |
| 2. Communications | | | | |
| | | | | |
| 3. Cage/Uncage | | | | |
| | | | | |
| 4. Speed Brake | | | | |
| | | | | |
| 5. Throttle Designator Control (TDC) | | | | |
| | | | | |
| 6. Automatic Throttle Control (ATC) | | | | |
| | | | | |
| 7. HARM Sequence/FLIRFOV/RAID | | | | |
| | | | | |
| 8. Exterior Lights | | | | |
| | | | | |
| 9. Radar Elevation | | | | |
| | | | | |

CONTROL STICK

| | NAV | A/A | A/G | EW |
|--|-----|-----|-----|----|
| 1. Air-to-Air Weapon Select | | | | |
| | | | | |
| 2. Pitch and Roll Trim | | | | |
| | | | | |
| 3. Sensor Control | | | | |
| | | | | |
| 4. A/G Weapon Release | | | | |
| | | | | |
| 5. Guns/Missiles Trigger | | | | |
| | | | | |
| 6. Baro Alt. Reset/Undesignate/NWS | | | | |
| | | | | |
| 7. Auto Pilot/NWS Disengage/G-limits Override | | | | |
| | | | | |

11. Assume that you are in the Air-to-Air Master Mode. For each HOTAS control listed below, please enter the difficulty in using the control, how often you would use it during an average mission, and how much practice is required to maintain your proficiency with it. Use the scale provided to make your ratings. Enter an "X" if a switch is not used

in this mode. For example, if you believe that using the throttle designator controller (TDC) is very difficult, you would place a "5" in the space provided. If you use it moderately frequently during a mission, you would enter a "3", and if you believe that the TDC requires little practice to maintain proficiency, enter a "1".

Rating Scale

1 2 3 4 5
:-----:-----:-----:-----:-----:
LOW MODERATE HIGH

1. Chaff/Flare Dispenser

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

2. Communication

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

3. Cage/Uncage

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

4. Speed Brake

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

5. Throttle Designator Controller (TDC)

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

6. Automatic Throttle Control (ATC)

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

7. HARM Sequence/FLIR FOV/RAID

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

12. Assume that you are in the Air-to-Ground Master Mode. For each HOTAS control listed below, please follow the same instructions that you did in question number 11, but remember to rate the HOTAS controls as if you were in Air-to-Ground mode.

Rating Scale

1 2 3 4 5
:-----:-----:-----:-----:-----:
LOW MODERATE HIGH

1. Chaff/Flare Dispenser

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

2. Communication

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

3. Cage/Uncage

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

4. Speed Brake

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

5. Throttle Designator Controller (TDC)

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

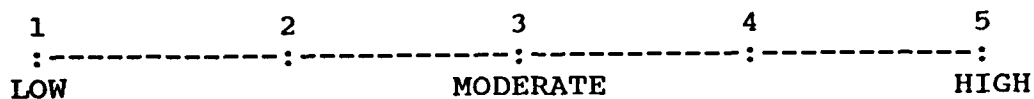
6. Automatic Throttle Control (ATC)

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

7. HARM Sequence/FLIR FOV/RAID

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

Rating Scale



8. Exterior Lights

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

9. Radar Elevation

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

10. Air-to-Air Weapon Select

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

11. Pitch and Roll Trim

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

12. Sensor Control

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

13. A/G Weapon Release

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

14. Gun/Missile Trigger

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

15. Barometric Altitude Reset/Undesignate/NWS

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

16. Autopilot/NWS Disengage/G-Limiter Override

DIFFICULTY: _____ FREQUENCY: _____ PRACTICE: _____

13. In an electronic warfare environment, what **controls/displays** are critical to successfully completing the mission? List the critical controls/displays.

A/A

A/G

- | | |
|----------|----------|
| 1. _____ | 1. _____ |
| 2. _____ | 2. _____ |
| 3. _____ | 3. _____ |
| 4. _____ | 4. _____ |
| 5. _____ | 5. _____ |

14. The radar may operate in any of the following modes during an A/A attack. In the space provided for each mode, enter a "1" if it is always used, enter a "2" if it is sometimes used, or enter a "3" if the radar mode is rarely used during an operational mission.

Rating Scale

| | | |
|--------|-----------|--------|
| 1 | 2 | 3 |
| :----- | :----- | :----- |
| always | sometimes | rarely |
| used | used | used |

- A. Range While Search (RWS): _____
- B. Velocity Search (VS): _____
- C. Track While Scan (TWS): _____
- D. ACM Modes
 - 1. Wide Acquisition (WACQ): _____
 - 2. Vertical Acquisition (VACQ): _____
 - 3. Boresight (BST): _____
- E. Gun Acquisition (GACQ): _____
- F. Single Target Track (STT): _____
- G. RAID Mode: _____
- H. Auto Acquisition (AACQ): _____
- I. Non-Cooperative Target Recognition (NCTR): _____
- J. Electronic Counter-Countermeasures (ECCM): _____

Please enter any comments:

15. FLIR, when integrated with the radar during A/A operations, may operate in any of the following modes. In the space provided for each mode, enter a "1" if it is always used, enter a "2" if it is sometimes used, or enter a "3" if the FLIR mode is rarely used during an operational mission.

Rating Scale

| | | |
|----------------|-------------------|----------------|
| 1 | 2 | 3 |
| :-----: | :-----: | :-----: |
| always used | sometimes used | rarely used |

- A. Velocity Vector Slaved (VVSLV): _____
 B. Radar LOS Slaved (RRSLV): _____
 C. Radar Offset LOS Slaved: _____
 D. Inertial LOS Slaved: _____
 E. FLIR Autotrack: _____

Please enter any comments:

16. The following radar modes are available for use in A/G weapon delivery. In the space provided for each mode, enter a "1" if it is always used, enter a "2" if it is sometimes used, or enter a "3" if the radar mode is rarely used during a operational mission.

Rating Scale

| | | |
|----------------|-------------------|----------------|
| 1 | 2 | 3 |
| :-----: | :-----: | :-----: |
| always used | sometimes used | rarely used |

- A. Real Beam Ground Map (MAP): _____
 B. Sea Surface Search (SEA): _____
 C. Ground Moving Target (GMT): _____
 D. Doppler Beam Sharpened Sector (EXP1): _____
 E. Doppler Beam Sharpened Patch (EXP2): _____
 F. Medium Resolution Synthetic Aperture (EXP3): _____
 G. Precision Velocity Update (PVU): _____
 H. Air-to-Ground Ranging (AGU): _____
 I. Terrain Avoidance (TA): _____

Please enter any comments:

17. Please list the pilot HOTAS skills that may deteriorate due to lack of application or practice.

| | |
|----------|----------|
| 1. _____ | 5. _____ |
| 2. _____ | 6. _____ |
| 3. _____ | 7. _____ |
| 4. _____ | 8. _____ |

18. Assume that a HOTAS PART TASK TRAINER is deployed on ship and available for your use. It takes up little space and no instructor is required. What HOTAS functions (e.g., weapon systems, mission scenarios, HARM, etc.) would be required on this trainer in order for you to maintain and/or develop the necessary skills to successfully perform A/A, A/G, and EW missions?

19. Would a trainer similar in concept and capability to DEVICE 15C13 (F/A-18 PTT) be an acceptable deployed trainer if it was converted to a compact form? Why or why not?

20. What is the most difficult mission scenario that you must accomplish, and why is it difficult?

21. Please enter any additional comments below that you have about the development of a deployable HOTAS part-task trainer (suggestions, complaints, etc.). Remember, this trainer is to be capable of assisting you in maintaining your HOTAS skills when deployed.

APPENDIX B
QUESTIONNAIRE DATA SUMMARY

PART I
PILOT BACKGROUND SUMMARY INFORMATION

1. Sample Size

| | |
|-----------------|----------|
| NAS Cecil Field | 16 |
| NAS Lemoore | <u>4</u> |
| Total | 20 |

2. Personnel Data

| | <u>Mean</u> | <u>Range</u> | |
|------|-------------|--------------|---------|
| Rank | LT | LT | to CAPT |
| Age | 30 | 25 | 39 |

3. Flight Hours

| | | | |
|-----------------|---------|-----|-------|
| Total | 1,387.5 | 350 | 3,800 |
| F/A-18 | 464.2 | 55 | 1,400 |
| Last six months | 116.5 | 50 | 200 |
| In the 15C13 | 17.55 | 5 | 75 |
| In the 2E7 | 42.9 | 10 | 150 |

PART II

QUESTIONNAIRE DATA SUMMARY

RESPONSE TOTALS AND MEANS

This part of the data summary is a compilation of the most frequent responses given in the questionnaire. Responses are listed either in the order of their frequency or, where ratings were called for, the average rating score. The frequency or rating average is shown after each response.

1. Master Modes causing greatest difficulty

a. A/A - 10 b. A/G - 8 c. NAV - 1

2. Master Modes considered most complex

a. A/A - 13 b. A/G - 7 c. NAV - 0

3. HOTAS controls/modes considered most important

| | |
|---|----|
| a. Throttle Designator Controller (TDC) | 18 |
| b. Air-to-Air Weapon Select | 14 |
| c. Sensor Control | 10 |
| d. Gun/Missile Trigger | 8 |
| e. Chaff/Flare Dispenser | 4 |
| f. HARM Seq./FLIR FOV/Raid | 4 |
| g. A/G Weapon Release | 4 |
| h. Communications | 4 |

4. HOTAS controls requiring most practice

| | |
|--------------------------------------|----|
| a. Throttle Designator Control (TDC) | 18 |
| b. Sensor Control | 14 |
| c. Radar Elevation | 13 |
| d. Air-to-Air Weapon Select | 10 |
| e. Chaff/Flare Dispenser | 9 |
| f. HARM seq./FLIR FOV/Raid | 6 |
| g. Cage/Uncage | 5 |

5. Controls/modes most difficult to set correctly

| <u>NAV Mode</u> | | <u>A/A Mode</u> | |
|----------------------|---|----------------------|----|
| a. TDC | 4 | a. TDC | 13 |
| b. Chaff/Flare Disp. | 2 | b. Radar Elevation | 10 |
| c. HARM Sequence | 2 | c. Sensor Control | 7 |
| | | d. Chaff/Flare Disp. | 5 |
| | | e. Cage/Uncage | 4 |
| | | f. A/A Weapon Select | 4 |

| <u>A/G Mode</u> | | <u>EW Mode</u> | |
|----------------------|----|------------------------|---|
| a. HARM Sequence | 12 | a. Chaff/Flare Disp. | 5 |
| b. TDC | 11 | b. HARM Seq./FLIR/Raid | 5 |
| c. Sensor Control | 7 | c. TDC | 4 |
| d. Chaff/Flare Disp. | 6 | d. Cage/Uncage | 3 |

Ranking Over All Modes

| | | | |
|----------------------|----|----------------------|----|
| a. TDC | 32 | e. Radar Elevation | 10 |
| b. HARM Sequence | 19 | f. Cage/Uncage | 7 |
| c. Chaff/Flare Disp. | 18 | g. A/A Weapon Select | 4 |
| d. Sensor Control | 14 | | |

6. Controls requiring fastest setup

| | |
|--|----|
| a. A/A weapon selection, radar setups, delivery | 18 |
| b. Changing back and forth from A/A to A/G Modes | 4 |
| c. Chaff/Flare Dispenser | 3 |
| d. HARM delivery sequence | 2 |
| d. TDC/Radar Elevation operation in A/A Mode | 2 |

7. Biggest challenge to use correctly once set up

| | |
|---|---|
| a. TDC in both A/A and A/G Master Modes | 6 |
| b. A/G weapon delivery (auto delivery, HARM sequence, getting weapon on highest priority target, etc. | 4 |
| c. A/A weapon selection, radar setting, delivery | 2 |

8. Skills most perishable without practice

| | |
|--|----|
| a. A/A weapon select, radar sorting, acquisition, targeting and delivery | 14 |
| b. TDC Sequences | 5 |
| c. HARM sequences/delivery | 5 |
| d. A/G weapon delivery switching | 2 |
| e. FLIR bombing | 2 |

9. Control setups most likely to be done incorrectly

| | |
|---|---|
| a. No response | 7 |
| b. A/G weapon delivery | 6 |
| c. A/A radar modes, elevation selection, sensor control | 4 |
| d. TDC operations | 3 |
| e. Use of Raid switch | 2 |

10. Controls requiring continuous practice to maintain proficiency (Scale of 1 = most to 9 = least)

| <u>NAV Mode</u> | | <u>A/A Mode</u> | |
|----------------------|-----|----------------------|-----|
| a. TDC | 4.6 | a. TDC | 2.7 |
| b. HARM Sequence | 4.6 | b. Chaff/Flare Disp. | 3.2 |
| c. Chaff/Flare Disp. | 5.4 | c. Sensor Control | 3.3 |
| d. Baro. Altimeter | 6.1 | d. HARM Sequence | 3.8 |
| e. Radar Elevation | 6.2 | e. Radar Elevation | 3.8 |

| <u>A/G Mode</u> | | <u>EW Mode</u> | |
|----------------------|-----|----------------------|-----|
| a. TDC | 2.4 | a. Chaff/Flare Disp. | 2.9 |
| b. Chaff/Flare Disp. | 3.2 | b. HARM Sequence | 4.1 |
| c. Sensor Control | 3.3 | c. TDC | 4.8 |
| d. HARM Sequence | 3.4 | d. Sensor Control | 5.3 |
| e. Radar elevation | 5.0 | | |

Ranking over all modes

| | | | |
|----------------------|-----|--------------------|-----|
| a. TDC | 3.4 | d. Sensor Control | 4.3 |
| b. Chaff/Flare Disp. | 3.5 | e. Radar Elevation | 5.2 |
| c. HARM Sequence | 3.9 | | |

11. A/A Master Mode Rankings (Scale of 5 = high to 1 = low)

| <u>Difficulty</u> | | <u>Frequency</u> | | <u>Practice</u> | |
|-------------------|-----|------------------|-----|-----------------|-----|
| TDC | 3.5 | Communications | 4.7 | TDC | 4.2 |
| Radar Elev. | 3.3 | A/A Weapon Sel. | 4.5 | Chaff/Flare | 3.4 |
| HARM Seq. | 2.8 | TDC | 4.4 | Radar Elev. | 3.4 |
| Sensor Cont. | 2.6 | Sensor Control | 4.0 | HARM Seq. | 3.1 |
| Chaff/Flare | 2.5 | Radar Elev. | 3.5 | Sensor Cont. | 3.1 |

12. A/G Master Mode Rankings (Scale of 5 = high to 1 = low)

| <u>Difficulty</u> | | <u>Frequency</u> | | <u>Practice</u> | |
|-------------------|-----|------------------|-----|-----------------|-----|
| TDC | 3.4 | Communications | 4.7 | TDC | 3.8 |
| HARM Seq. | 2.9 | TDC | 3.9 | Chaff/Flare | 3.1 |
| Chaff/Flare | 2.7 | A/G Weapon Sel. | 3.6 | HARM Seq. | 3.0 |
| Radar Elev. | 2.4 | Sensor Cont. | 3.5 | Sensor Cont. | 2.9 |
| Sensor Cont. | 2.2 | A/A Weapon Sel. | 3.4 | Radar Elev. | 2.6 |

13. Most critical controls/displays in an EW environment

| <u>Controls</u> | <u>A/A Mode</u> | <u>A/G Mode</u> |
|--------------------------------|-----------------|-----------------|
| a. Chaff/Flare Dispenser | 7 | 6 |
| b. Radar Elevation | 5 | - |
| c. HARM Seq./FLIR FOV/Raid | 4 | 7 |
| d. Throttle Designator Control | 3 | 2 |
| e. Weapon Select | 3 | - |
| f. Weapon Release | - | 2 |

| <u>Displays</u> | <u>A/A Mode</u> | <u>A/G Mode</u> |
|--------------------|-----------------|-----------------|
| a. ALR-67 | 12 | 11 |
| b. HUD displays | 7 | 9 |
| c. Radar displays | 5 | 3 |
| d. EW displays | 4 | 4 |
| e. ALQ-126 | 4 | 5 |
| f. HARM displays | 3 | 3 |
| g. ALR-39 | 2 | 2 |
| h. Stores displays | 2 | 2 |

14. Most frequently used radar modes during A/A operations
(Scale of 1 = always used to 3 = rarely used)
- | | |
|--|-----|
| a. Single Target Track (STT) | 1.0 |
| b. Range While Search (RWS) | 1.2 |
| c. Non-Cooperative Target Recognition (NCTR) | 1.3 |
| d. ACM Boresight (BST) | 1.4 |
| e. Auto Acquisition (AACQ) | 1.4 |
15. Most frequently used FLIR modes during A/A operations
(Scale of 1 = always used to 3 = rarely used)
- | | |
|-----------------------------------|-----|
| a. Velocity vector Slaved (VVSLV) | 1.5 |
| b. Radar LOS Slaved (RSLV) | 1.5 |
| c. FLIR Auto Track | 1.6 |
16. Most frequently used radar modes during A/G operations
(Scale of 1 = always used to 3 = rarely used)
- | | |
|--|-----|
| a. Doppler Beam Sharpened Patch (EXP2) | 1.3 |
| b. Air-to-Ground Ranging (AGR) | 1.3 |
| c. Real Beam Ground Map (MAP) | 1.5 |
| d. Medium Resolution Synthetic Aperture (EXP3) | 1.7 |
| e. Doppler Beam Sharpened Sector (EXP1) | 1.7 |
17. Skills that may deteriorate with lack of use
- | | |
|--|----|
| a. Throttle Designator Control operations | 10 |
| b. A/A, A/G and general FLIR operations | 9 |
| c. A/A targeting, radar setups | 8 |
| d. HARM/SHRIKE/WALLEYE delivery | 7 |
| e. Use of the Radar Elevation Switch | 6 |
| f. Use of the Weapon Select Switch | 4 |
| g. Use of the Chaff/Flare Dispenser Switch | 4 |
18. HOTAS functions that should be required in trainer
- | | |
|---|----|
| a. HARM/WALLEYE delivery | 14 |
| b. A/A targeting/radar sorting | 8 |
| c. A/A missions against all types of bogeys | 7 |
| d. FLIR sequences | 5 |
| e. A/G weapons sequences/maneuvers | 3 |

19. Would a 15C13 type trainer be acceptable?

Yes, but only with major added capability 12

No because: 7

- a. Too simple, canned or perfect
- b. Should be an OFT or WTT
- c. Not all controls work
- d. No visual displays
- e. No HARM, FLIR, etc. capability
- f. No A/G, EW capability

20. Most difficult mission scenarios

- a. Self escorted, low altitude mission into a high threat (hostile air, SAM and AAA) environment with HARM/EW capability on board 14
- b. Ability to perform FLIR operations 2
- c. A/A missions against smart A/A threats 2

PART III
QUESTIONNAIRE DATA SUMMARY
RESPONSE PERCENTAGES

This part of the data summary cites the results of 12 survey items expressed in percentages of the pilots responding to the items.

1. QUESTION 1: Master modes causing greatest difficulty

| | | |
|--------------|-----------|----------|
| a. A/A - 53% | A/G - 42% | NAV - 5% |
|--------------|-----------|----------|

2. QUESTION 2: Master Modes considered most complex

| | | |
|--------------|-----------|----------|
| a. A/A - 65% | A/G - 35% | NAV - 0% |
|--------------|-----------|----------|

3. QUESTION 3: HOTAS controls/modes considered most important

| | |
|---|-----|
| a. Throttle Designator Controller (TDC) | 90% |
| b. Air-to-Air Weapon Select | 70% |
| c. Sensor Control | 50% |
| d. Gun/Missile Trigger | 44% |

4. QUESTION 4: HOTAS controls requiring most practice

| | |
|-----------------------------------|-----|
| a. Throttle Designator Controller | 90% |
| b. Sensor Control | 70% |
| c. Radar Elevation | 65% |
| d. Air-to-Air Weapon Select | 50% |
| e. Chaff/Flare Dispenser | 45% |

5. QUESTION 5: Controls/modes most difficult to set correctly

THROTTLES

| | NAV | A/A | A/G | EW |
|--------------------------------------|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 11% | 33% | 28% | 28% |
| b. Communications | - | - | - | - |
| c. Cage/Uncage | - | 22% | 11% | 17% |
| d. Speed Brake | - | - | - | - |
| e. Throttle Designator Control (TDC) | 22% | 72% | 61% | 22% |
| f. Automatic Throttle Control (ATC) | 5% | - | - | - |
| g. HARM Sequence/FLIR FOV/RAID | 11% | 17% | 67% | 28% |
| h. Exterior Lights | - | - | - | - |
| i. Radar Elevation | 5% | 55% | 17% | - |

CONTROL STICK

| | NAV | A/A | A/G | EW |
|--------------------------------------|-----|-----|-----|----|
| a. Air-to-Air Weapon Select | - | 22% | - | - |
| b. Pitch and Roll Trim | 5% | - | - | - |
| c. Sensor Control | - | 39% | 39% | 5% |
| d. A/G Weapon Release | - | - | 17% | - |
| e. Gun/Missile Trigger | - | 11% | 5% | - |
| f. Baro. Alt. Reset/Undesignate/NWS | - | 11% | 5% | - |
| g. Auto Pilot/NWS Disc./G-Limiter OR | 5% | 17% | 5% | 5% |

6. QUESTION 10: Controls requiring continuous practice to maintain proficiency (Scale of 1 = most to 9 = least)

THROTTLES

Chaff/Flare Dispenser

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|-----|-----|---|----|-----|-----|
| a. NAV | 20% | 20% | - | 10% | 10% | - | - | 10% | 30% |
| b. A/A | 33% | 17% | 22% | 6% | 6% | - | 5% | - | 11% |
| c. A/G | 38% | 20% | 7% | 11% | 11% | - | - | - | 11% |
| d. EW | 50% | 20% | - | 7% | 7% | - | - | - | 14% |

Communications

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---|---|-----|---|---|----|-----|-----|-----|
| a. NAV | - | - | 7% | - | - | - | 7% | 26% | 26% |
| b. A/A | - | - | 7% | - | - | 7% | 7% | 21% | 57% |
| c. A/G | - | - | 7% | - | - | 7% | 21% | 21% | 43% |
| d. EW | - | - | 11% | - | - | - | 11% | 22% | 57% |

QUESTION 10 (Continued)

Cage/Uncage

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---|----|-----|-----|-----|-----|-----|-----|-----|
| a. NAV | - | - | - | - | 14% | 7% | 7% | 21% | 50% |
| b. A/A | - | 7% | 21% | 21% | 14% | - | 7% | 7% | 21% |
| c. A/G | - | - | 8% | 17% | 17% | - | 8% | 17% | 33% |
| d. EW | - | - | - | - | 11% | 11% | 11% | 11% | 56% |

Speed Brake

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---|---|----|---|-----|-----|-----|-----|-----|
| a. NAV | - | - | 7% | - | 7% | - | 7% | 7% | 71% |
| b. A/A | - | - | - | - | - | 8% | 11% | 8% | 71% |
| c. A/G | - | - | - | - | 11% | - | 18% | 11% | 56% |
| d. EW | - | - | - | - | - | 12% | 12% | 12% | 64% |

Throttle Designator Control

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|-----|----|----|----|-----|-----|
| a. NAV | 21% | 14% | 21% | - | 7% | - | - | 14% | 21% |
| b. A/A | 35% | 29% | 12% | 12% | - | - | 5% | - | 5% |
| c. A/G | 44% | 22% | 16% | 6% | - | 6% | - | - | 6% |
| d. EW | - | 22% | 22% | 22% | - | - | - | 22% | 11% |

Automatic Throttle Control

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---|----|---|-----|-----|-----|-----|-----|-----|
| a. NAV | - | 7% | - | 7% | 7% | - | 7% | 14% | 57% |
| b. A/A | - | - | - | 9% | 9% | 18% | - | 18% | 45% |
| c. A/G | - | - | - | 9% | 18% | 9% | 27% | 9% | 27% |
| d. EW | - | - | - | 12% | 12% | 12% | - | 12% | 50% |

HARM Sequence/FLIR FOV/Raid

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|-----|----|----|----|-----|-----|
| a. NAV | 17% | - | 17% | 33% | 8% | - | - | 8% | 17% |
| b. A/A | 14% | 21% | 21% | 14% | 7% | - | 7% | 14% | - |
| c. A/G | 25% | 18% | 25% | 12% | - | 6% | - | - | 13% |
| d. EW | 25% | 18% | 17% | 8% | 8% | - | - | - | 25% |

QUESTION 10 (Continued)

Exterior Lights

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---|---|---|---|---|---|-----|-----|-----|
| a. NAV | - | - | - | - | - | - | 14% | - | 86% |
| b. A/A | - | - | - | - | - | - | - | 36% | 64% |
| c. A/G | - | - | - | - | - | - | 18% | 9% | 72% |
| d. EW | - | - | - | - | - | - | - | 22% | 78% |

Radar Elevation

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|-----|-----|----|----|-----|-----|
| a. NAV | 8% | 8% | - | 8% | 15% | - | 8% | 23% | 31% |
| b. A/A | 22% | 17% | 17% | 7% | 5% | 5% | - | - | 17% |
| c. A/G | 8% | 15% | 8% | 31% | - | 8% | - | 8% | 23% |
| d. EW | - | - | - | 29% | 14% | - | - | - | 57% |

CONTROL STICK

Air-to-Air Weapon Select

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|-----|-----|---|----|---|-----|
| a. NAV | - | - | 11% | - | - | - | - | - | 78% |
| b. A/A | 10% | 12% | 23% | 12% | 6% | - | 6% | - | 23% |
| c. A/G | 12% | - | 13% | - | - | - | - | - | 75% |
| d. EW | - | - | 14% | - | 14% | - | - | - | 72% |

Pitch and Roll Trim

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|---|---|---|---|-----|----|-----|-----|
| a. NAV | 7% | - | - | - | - | 6% | 6% | 21% | 47% |
| b. A/A | 10% | - | - | - | - | 10% | - | 20% | 50% |
| c. A/G | 10% | - | - | - | - | 10% | - | 20% | 60% |
| d. EW | 13% | - | - | - | - | 12% | - | 12% | 63% |

Sensor Control

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|-----|-----|-----|----|-----|-----|
| a. NAV | - | 10% | 10% | 10% | 10% | - | - | 20% | 40% |
| b. A/A | 18% | 23% | 29% | 12% | 6% | - | - | 6% | 6% |
| c. A/G | 27% | 27% | 13% | - | 13% | 6% | 6% | 6% | - |
| d. EW | 11% | 11% | 11% | - | 22% | 11% | - | 11% | 22% |

QUESTION 10 (Continued)

Air-to-Ground Weapon Release

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|----|----|-----|----|----|---|---|-----|-----|
| a. NAV | - | 8% | 8% | 8% | - | - | - | 8% | 67% |
| b. A/A | - | 6% | 17% | 6% | 6% | - | - | - | 58% |
| c. A/G | 7% | 9% | 18% | 9% | - | - | 9 | - | 55% |
| d. EW | - | - | - | - | - | - | - | 33% | 67% |

Gun/Missile Trigger

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|----|---|-----|-----|-----|-----|---|-----|-----|
| a. NAV | - | - | - | - | 22% | - | - | - | 78% |
| b. A/A | 7% | - | 13% | - | 20% | - | - | 13% | 47% |
| c. A/G | 9% | - | - | 18% | 9% | - | - | 9% | 55% |
| d. EW | - | - | - | - | 13% | 13% | - | - | 75% |

Baro. Alt. Reset/Undesignate/NWS

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|-----|----|-----|----|---|----|-----|
| a. NAV | 23% | 7% | - | 7% | - | - | - | 7% | 54% |
| b. A/A | - | 7% | 21% | - | 14% | 7% | - | 7% | 43% |
| c. A/G | 7% | 14% | 14% | 7% | 7% | - | - | 7% | 43% |
| d. EW | - | 8% | 8 | 8% | - | - | - | 8% | 67% |

Auto Pilot/NWS Disengage/G-Limiter Override

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|---|----|-----|----|----|---|----|-----|-----|
| a. NAV | - | 8% | 8% | 8% | - | - | - | 8% | 67% |
| b. A/A | - | 6% | 17% | 6% | 6% | - | - | - | 58% |
| c. A/G | - | 9% | 18% | 9% | - | - | 9% | - | 55% |
| d. EW | - | - | - | - | - | - | - | 33% | 67% |

7. QUESTION 11: In the Air-to-Air Master Mode, rate each control for difficulty in use, frequency of use, and practice required to maintain proficiency. (Scale of 1 = low to 5 = high)

THROTTLES

Difficulty

| | 1 | 2 | 3 | 4 | 5 |
|----------------------------|------|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 25% | 20% | 35% | 15% | 5% |
| b. Communications | 85% | 15% | - | - | - |
| c. Cage/Uncage | 40% | 20% | 35% | 5% | - |
| d. Speed Brake | 100% | - | - | - | - |
| e. Throttle Desig. Cont. | 10% | 10% | 20% | 35% | 25% |
| f. Auto Throttle Cont. | 85% | 10% | - | 5% | - |
| g. HARM Seq./FLIR FOV/Raid | 16% | 21% | 37% | 16% | 10% |
| h. Exterior Lights | 95% | 5% | - | - | - |
| i. Radar Elevation | 10% | 15% | 35% | 15% | 25% |

Frequency

| | 1 | 2 | 3 | 4 | 5 |
|----------------------------|-----|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 30% | 10% | 20% | 15% | 20% |
| b. Communications | 5% | - | - | 5% | 90% |
| c. Cage/Uncage | 15% | 15% | 40% | 15% | 15% |
| d. Speed Brake | 30% | 20% | 20% | - | 30% |
| e. Throttle Des. Cont. | - | - | 20% | 15% | 65% |
| f. Auto Throttle Cont. | 30% | 30% | 25% | 10% | 5% |
| g. HARM Seq./FLIR FOV/Raid | 68% | 16% | 16% | - | - |
| h. Exterior Lights | 70% | 10% | 5% | 5% | 10% |
| i. Radar Elevation | 10% | 10% | 30% | 15% | 35% |

Practice

| | 1 | 2 | 3 | 4 | 5 |
|----------------------------|-----|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 15% | 10% | 20% | 25% | 30% |
| b. Communications | 65% | 20% | - | - | 15% |
| c. Cage/Uncage | 30% | 20% | 20% | 25% | 5% |
| d. Speed Brake | 85% | 5% | 5% | - | 5% |
| e. Throttle Des. Cont. | 5% | 5% | 15% | 15% | 60% |
| f. Auto Throttle Cont. | 70% | 25% | 5% | - | - |
| g. HARM Seq./FLIR FOV/Raid | 26% | 16% | 16% | 5% | 37% |
| h. Exterior Lights | 85% | 10% | - | - | 5% |
| i. Radar Elevation | 15% | 15% | 25% | 5% | 40% |

QUESTION 11 (Continued)

CONTROL STICK

Difficulty

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------|-----|-----|-----|-----|-----|
| a. A/A Weapon Select | 60% | 30% | 5% | 5% | - |
| b. Pitch and Roll Trim | 85% | 10% | 5% | - | - |
| c. Sensor Control | 20% | 30% | 30% | 10% | 10% |
| d. A/G Weapon Release | 88% | 6% | 6% | - | - |
| e. Gun/Missile Trigger | 85% | 5% | 10% | - | - |
| f. Baro Alt Reset/Undes/NWS | 80% | 10% | 5% | 5% | - |
| g. AP/NWS Dis/G-Limiter OR | 75% | 15% | - | 10% | - |

Frequency

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------|-----|-----|-----|-----|-----|
| a. A/A Weapon Select | - | - | 15% | 20% | 65% |
| b. Pitch and Roll Trim | 45% | 15% | 10% | 5% | 25% |
| c. Sensor Control | 5% | - | 25% | 25% | 45% |
| d. A/G Weapon Release | 17% | 23% | 35% | 6% | 17% |
| e. Gun/Missile Trigger | 21% | 10% | 42% | 6% | 21% |
| f. Baro Alt Reset/Undes/NWS | 26% | 5% | 32% | 10% | 26% |
| g. AP/NWS Dis/G-Limiter OR | 50% | 16% | 26% | - | - |

Practice

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------|-----|-----|-----|-----|-----|
| a. A/A Weapon Select | 30% | 20% | 20% | 20% | 10% |
| b. Pitch and Roll Trim | 80% | 10% | 5% | 5% | - |
| c. Sensor Control | 20% | 20% | 10% | 30% | 20% |
| d. A/G Weapon Release | 47% | 23% | 12% | 6% | 12% |
| e. Gun/Missile Trigger | 63% | 10% | 10% | 6% | 10% |
| f. Baro Alt Reset/Undes/NWS | 74% | 5% | 16% | - | 5% |
| g. AP/NWS Dis/G-Limiter OR | 84% | 5% | 5% | 5% | - |

8. QUESTION 12: In the Air-to-Ground Master Mode, rate each control for difficulty in use, frequency of use, and practice required to maintain proficiency. (Scale of 1 = low to 5 = high)

THROTTLES

Difficulty

| | 1 | 2 | 3 | 4 | 5 |
|----------------------------|-----|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 25% | 15% | 35% | 15% | 10% |
| b. Communications | 95% | 5% | - | - | - |
| c. Cage/Uncage | 84% | 10% | 6% | - | - |
| d. Speed Brake | 95% | 5% | - | - | - |
| e. Throttle Desig. Cont. | 5% | 25% | 20% | 25% | 25% |
| f. Auto Throttle Cont. | 85% | 15% | - | - | - |
| g. HARM Seq./FLIR FOV/Raid | 26% | 10% | 32% | 10% | 21% |
| h. Exterior Lights | 95% | 5% | - | - | - |
| i. Radar Elevation | 35% | 15% | 25% | 20% | 5% |

Frequency

| | 1 | 2 | 3 | 4 | 5 |
|----------------------------|-----|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 25% | 20% | 25% | 20% | 10% |
| b. Communications | 5% | - | - | 10% | 85% |
| c. Cage/Uncage | 35% | 20% | 25% | 15% | 5% |
| d. Speed Brake | 55% | 5% | 10% | 10% | 20% |
| e. Throttle Des. Cont. | - | 10% | 30% | 20% | 40% |
| f. Auto Throttle Cont. | 60% | 10% | 25% | - | 5% |
| g. HARM Seq./FLIR FOV/Raid | 42% | 26% | 21% | 10% | - |
| h. Exterior Lights | 85% | - | 5% | 5% | 5% |
| i. Radar Elevation | 35% | 15% | 25% | 20% | 5% |

Practice

| | 1 | 2 | 3 | 4 | 5 |
|----------------------------|-----|-----|-----|-----|-----|
| a. Chaff/Flare Dispenser | 20% | 20% | 10% | 15% | 30% |
| b. Communications | 80% | 5% | 5% | - | 10% |
| c. Cage/Uncage | 70% | 10% | 5% | - | 15% |
| d. Speed Brake | 90% | 5% | - | - | 5% |
| e. Throttle Des. Cont. | 5% | 15% | 20% | 15% | 45% |
| f. Auto Throttle Cont. | 80% | 15% | 5% | - | - |
| g. HARM Seq./FLIR FOV/Raid | 26% | 16% | 16% | 10% | 33% |
| h. Exterior Lights | 95% | - | - | - | 5% |
| i. Radar Elevation | 35% | 15% | 20% | 10% | 20% |

QUESTION 12 Continued)

CONTROL STICK

Difficulty

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------|-----|-----|-----|-----|----|
| a. A/A Weapon Select | 68 | 10% | 21% | - | - |
| b. Pitch and Roll Trim | 84% | 10% | 6% | - | - |
| c. Sensor Control | 30% | 30% | 30% | 10% | - |
| d. A/G Weapon Release | 89% | - | 11% | - | - |
| e. Gun/Missile Trigger | 55% | - | 5% | - | - |
| f. Baro Alt Reset/Undes/NWS | 90% | 5% | 5% | - | - |
| g. AP/NWS Dis/G-Limiter OR | 80% | 5% | 5% | 5% | 5% |

Frequency

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------|-----|-----|-----|-----|-----|
| a. A/A Weapon Select | 12% | 19% | 12% | 19% | 38% |
| b. Pitch and Roll Trim | 47% | - | 21% | 10% | 21% |
| c. Sensor Control | - | 15% | 40% | 25% | 20% |
| d. A/G Weapon Release | 11% | 5% | 37% | 11% | 37% |
| e. Gun/Missile Trigger | 32% | 26% | 10% | 5% | 26% |
| f. Baro Alt Reset/Undes/NWS | 24% | 18% | 35% | 11% | 11% |
| g. AP/NWS Dis/G-Limiter OR | 65% | 15% | 15% | 5% | - |

Practice

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------|-----|-----|-----|-----|-----|
| a. A/A Weapon Select | 29% | 35% | 18% | 6% | 12% |
| b. Pitch and Roll Trim | 21% | 79% | 5% | 5% | - |
| c. Sensor Control | 20% | 20% | 15% | 35% | 10% |
| d. A/G Weapon Release | 67% | - | 11% | - | 22% |
| e. Gun/Missile Trigger | 63% | 16% | 16% | - | 5% |
| f. Baro Alt Reset/Undes/NWS | 68% | 26% | 6% | - | - |
| g. AP/NWS Dis/G-Limiter OR | 85% | 10% | 5% | - | - |

9. QUESTION 13: List the critical controls and displays in an EW environment

| <u>Controls</u> | <u>A/A Mode</u> | <u>A/G Mode</u> |
|------------------------------|-----------------|-----------------|
| a. Chaff/Flare Disp. Switch | 35% | 30% |
| b. Radar Elevation Switch | 25% | 10% |
| c. HARM Seq./FLIR/Raid | 20% | 35% |
| d. Throttle Designator Cont. | 15% | 10% |
| e. Weapon Select Switch | 15% | ~% |
| f. Weapon Release Switch | - | 10% |

| <u>Displays</u> | | |
|--------------------|-----|-----|
| a. ALR-67 with HUD | 60% | 55% |
| b. HUD displays | 35% | 45% |
| c. Radar Displays | 25% | 15% |
| d. EW displays | 20% | 20% |
| e. ALQ-126 | 20% | 25% |
| f. ALE-39 | 20 | 20% |
| g. HARM display | 15% | 15% |
| f. Stores display | 10% | 10% |

10. QUESTION 14: Identify the frequency of use of the radar modes in the A/A Master Mode

| <u>Mode</u> | <u>Always</u> | <u>Sometimes</u> | <u>Rarely</u> |
|------------------------------------|---------------|------------------|---------------|
| a. Single Target Track (STT) | 85% | 15% | - |
| b. Range While Search (RWS) | 85% | 10% | 5% |
| c. Non-Coop Target Recog. (NCTR) | 60% | 35% | 5% |
| d. Elect Count-Count Meas. (ECCM) | 60% | 25% | 15% |
| e. ACM Boresight (BST) | 55% | 30% | 15% |
| f. Auto Acquisition (AACQ) | 50% | 45% | 5% |
| g. ACM Vertical Acquisition (VACQ) | 30% | 65% | 5% |
| h. Raid | 25% | 50% | 25% |
| i. ACM Wide Acquisition (WACQ) | 20% | 45% | 35% |
| j. Gun Acquisition (GACQ) | 15% | 65% | 20% |
| k. Track While Scan (TWS) | 10% | 75% | 15% |
| l. Velocity Search (VS) | - | 15% | 85% |

QUESTION 14 (Continued)

11. QUESTION 15: Identify the frequency of use of the FLIR modes when integrated with radar available in the A/A Master Mode

| <u>Mode</u> | <u>Always</u> | <u>Sometimes</u> | <u>Rarely</u> |
|-----------------------------------|---------------|------------------|---------------|
| a. Velocity Vector Slaved (VVSLV) | 50% | 50% | - |
| b. Radar LOS Slaved (RRSLV) | 50% | 50% | - |
| c. FLIR Autotrack | 44% | 50% | 6% |
| d. Radar Offset LOS Slaved | 6% | 38% | 56% |
| e. Inertial LOS Slaved | 6% | 25% | 69% |

Note: Four pilots indicated they had never used FLIR.

12. QUESTION 16: Identify the frequency of use of the FLIR modes when integrated with the radar available in the A/G Master Mode

| <u>Mode</u> | <u>Always</u> | <u>Sometimes</u> | <u>Rarely</u> |
|--|---------------|------------------|---------------|
| a. Doppler Beam Sharpened Patch (EXP2) | 65% | 35% | - |
| b. Air-to-Ground Ranging (AGR) | 65% | 30% | - |
| c. Real Beam Ground Map (MAP) | 50% | 40% | 10% |
| d. Doppler Beam Sharpened Sector EXP1) | 35% | 50% | 15% |
| e. Medium Res. Syn. Aperture (EXP 3) | 35% | 50% | 15% |
| f. Sea Surface Search (SEA) | 26% | 53% | 21% |
| g. Ground Moving Target (GMT) | 10% | 60% | 30% |
| h. Precision Velocity Update (PVU) | 10% | 35% | 55% |
| i. Terrain Avoidance (TA) | - | 5% | 95% |

13. QUESTION 17: Identify the pilot skills most likely to deteriorate with lack of practice.

| | |
|--|-----|
| a. Throttle Designator Control operations | 50% |
| b. A/A, A/G and general FLIR operations | 45% |
| c. A/A targeting, radar setups | 40% |
| d. HARM/SHRIKE/WALLEYE delivery | 35% |
| e. Use of the Radar Elevation Switch | 30% |
| f. Use of the Weapon Select Switch | 20% |
| g. Use of the Chaff/Flare Dispenser Switch | 20% |

14. QUESTION 18: What training capabilities should be required of a HOTAS deployable part task trainer?

- | | |
|---|-----|
| a. HARM/WALLEYE delivery | 70% |
| b. A/A targeting/radar sorting | 40% |
| c. A/A missions against all types of bogeys | 35% |
| d. FLIR sequences | 25% |
| e. A/G weapons sequences/maneuvers | 25% |

APPENDIX C

TRAINER TASK DESCRIPTION MATRIX

References

F-18 Pilot Objectives Hierarchy Report, 6/30/88 - Primary source for tasks

MDC B0528, Operation of F/A-18 Avionics Subsystems with 87X-OFPs, 3/1/88,
Primary Source of Technical Information

A1-F18AC-NFM-100/(c), Supplemental NATOPS - Supplemental source of
Technical Information

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|--|---|---|---|----------|
| 1.0 | PERFORM AIR-TO-GROUND TACTICS | Sim/Aircraft Airborne; single/multi-plane flight; all weapons/configuration available; day/night; IMC/VMC condition | | Aircraft flight dynamics, Mission Computer function, Command Launch Computer function HUD, DDI, HI, HOTAS functions | High |
| 1.1 | PERFORM A/G COMBAT CHECKS | Sim/Aircraft equipped with A/G Weapons | | | High |
| 1.1.1 | SET UP COCKPIT FOR A/G WEAPON DELIVERY | | | | |
| 1.1.1.1 | Select A/G Master Mode | | Master Arm Panel with switches IL-DDI-Store Management Display | | |
| 1.1.1.2 | Activate Master Arm Switch | | Master Arm Switch | | |
| 1.1.1.3 | Check status of A/G weapons | | IL-DDI-Stores Format Displays | | |
| 1.1.1.4 | Set up ECM equipment | Sim/Aircraft equipped with ECM equipment | Sensor control panel with switches | ALQ-126B Countermeasure Set functions ALE-39 Dispensing Set functions ALR-67 Radar Warning Receiver (RWR) functions | High |
| 1.2 | NAVIGATE TO TARGET | Sim/Aircraft airborne; operate INS, Radar day/night; IMC/VMC conditions | | | |
| 1.2.1 | PERFORM VISUAL NAVIGATION | Sim/Aircraft on preplanned DR route | HUD - Navigation display HI-HSI display, MAP display | Visual geographic area with landmarks, targets | High |
| 1.2.1.1 | Interpret HUD and HSI displays | | | | |
| 1.2.1.2 | Assign TDC to HI to slew map | | Sensor Control Switch on control stick, TDC on throttles | | |
| 1.2.2 | PERFORM RADAR NAVIGATION | Sim/Aircraft Airborne, Operable A/G radar | | Digital radar landmarks for selected geographical area | Medium |
| 1.2.2.1 | Turn on radar | | Sensor Control Panel - Radar Switch | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|---|--|--|---|----------|
| 1.2.2.2 | Select A/G radar operation | | SURF switch on radar format - R.DD1 R.DD1 - Map format | | |
| 1.2.2.3 | Assign TDC to radar | Operable KOTAS system | Sensor Control Switch TDC | | |
| 1.2.2.4 | Select Alternate A/G radar modes as required | | R.DD1 - MAP, EXP1, EXP2, EXP3 SEA, GMT - display formats | | |
| 1.2.2.5 | Change gain, beam, antenna elevating range scale, azimuth scan as necessary | | | A/G radar functions | |
| 1.2.2.6 | Interpret displays and symbology | | | | |
| 1.2.3 | OPERATE FLIR | Sim/Aircraft Airborne; equipped with FLIR pod mounted sensor; FLIR type targets available | | Infrared targets in simulated environment | Medium |
| 1.2.3.1 | Turn on FLIR power | | Sensor control panel - FLIR switch | | |
| 1.2.3.2 | Select FLIR Display | | DD1 - FLIR button | | |
| 1.2.3.3 | Assign TDC to FLIR | | Sensor Control Switch | | |
| 1.2.3.4 | Command FLIR to search | | DD1 - WSLV display Cage/Uncage Switch | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|--|---|--|--|----------|
| 1.2.3.5 | Select options as desired | | DDI - Displays HUD - FLIR reticle display | | |
| 1.2.3.6 | Designate FLIR target | | | | |
| 1.2.3.6.1 | Reposition FLIR LOS | | TDC HUD - display | | |
| 1.2.3.6.2 | Acquire target | | Sensor Control Switch DDI - FLIR display | A/G radar functions | |
| 1.2.3.7 | Designate new target/aim point | | TDC DDI - FLIR display | | |
| 1.3 | DESIGNATE OAP/TARGET | Sim/Aircraft Airborne; in target area - within range of on-board sensor | R.DDI - Sensor displays HUD - Navigation displays | | |
| 1.3.1 | PERFORM VISUAL DETECTION/ DESIGNATION | Sim/Aircraft within visual sighting range Conditions conducive to visual detection | | Visual environment with targets available | High |
| 1.3.2 | PERFORM RADAR DETECTION/ DESIGNATION | Sim/Aircraft Airborne with A/G radar capability; targets within radar range; suitable for radar detection | R.DDI - Radar displays HUD TDC | Radar landmass environment with radar targets | High |
| 1.3.3 | PERFORM FLIR DETECTION/ DESIGNATION | Sim/Aircraft Airborne; target and environment suitable for FLIR | R.DDI - FLIR displays FLIR FOV Switch on throttle HUD TDC | FLIR pod capability | Medium |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|--------|---|--|---|---|----------|
| 1.3.4 | PERFORM LST DETECTION/ DESIGNATION | Target being illuminated by airborne or ground designation | R.DDI - LST/CAM Displays HUD - LST displays TDC | LST pod capability | Low |
| 1.3.5 | PERFORM EW/HARM DETECTION/ DESIGNATION | Sim/Aircraft Airborne; HARM on-board; within detection range of ground/airborne emitters | R.DDI - Radar displays HUD RWR - Displays and tones | HARM Pod Capability RWR EW environment | High |
| 1.3.6 | PERFORM DATA LINK DETECTION/ DESIGNATION | Sim/Aircraft Airborne; Configured for data link detection | R.DDI - Radar displays - data link overlays HUD | Data link environment | Low |
| 1.4 | PERFORM TARGET ACQUISITION | | | | |
| 1.4.1 | PERFORM HARM ACQUISITION | Sim/Aircraft Airborne; within range of enemy ground emitters; aircraft configured with HARM | R.DDI - Radar displays HUD RWR - Displays | Hostile emitter environment, AAA sites, SAM sites. HARM sensor functions RWR functions | High |
| 1.4.2 | PERFORM WALLEYE ACQUISITION | Sim/Aircraft Airborne; targets suitable for Walleye; aircraft configured with Walleye I or Walleye ER/DL | L.DDI-Walleye displays HUD | Walleye visual environment For Walleye ER/DL - function of AWW-9. Data Link Pod Required | Low |
| 1.4.3 | PERFORM MAVERICK ACQUISITION | Sim/Aircraft Airborne configured for Maverick delivery | L.DDI - Maverick format displays | Suitable targets available Laser designation of target | Low |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|---|--|---|--|----------|
| 1.5 | PERFORM HARM DELIVERY | Sim/Aircraft Airborne; within range of enemy ground emitters. Aircraft configured with HARM missiles | | Visual/Radar geographical area with enemy emitters (targets) | High |
| 1.5.1 | SELECT HARM OPTIONS | | | | |
| 1.5.1.1 | Select Pre-Briefed mode (PB) | | L.DDI - Stores Format(PB Mode) TOO (Mode), (SP Mode) Sensor Switch TDC | | |
| 1.5.1.2 | Select Target-of-Opportunity Mode (TOO) | | | | |
| 1.5.1.3 | Select Self Protect (SP)/Pullback (PLBK) Mode | | | | |
| 1.5.2 | ASSIGN TDC TO HUD | | | | |
| 1.5.3 | CHECK STATUS OF WEAPONS | | L.DDI -Stores Format | | |
| 1.5.4 | PERFORM HARM SEQUENCE FOR ALTERNATE TARGETS | | HARM Sequence Switch on Throttle | | |
| 1.5.5 | SELECT PRIORITY HARM FOR DELIVERY | | | | |
| 1.5.6 | PERFORM PRE-BRIEFED (PB) HARM DELIVERY | Pre-Planned Target | Sensor Switch TDC HI with HSI display | HARM seeker sensor functions | High |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|---|--|--|-------------------------|----------|
| 1.5.6.1 | Assign TDC to Horizontal Indicator (HI) | | LDDI - HARM PB format HUD - PB Mode display | | |
| 1.5.6.2 | Enter Target Number | | Up Font Control (UFC) | | |
| 1.5.6.3 | Select Pullup Option | | | | |
| 1.5.6.3.1 | Select A/C Pullup | | HUD - Pullup Display | | |
| 1.5.6.3.2 | Select HARM Pullup | | HUD - Pullup Display | | |
| 1.5.6.4 | Confirm Target | Target acquired. Conditions ready for Launch | | | |
| 1.5.6.5 | Activate Weapon Release button | | Weapon Release button on Control Stick | | |
| 1.5.6.6 | Perform pullup maneuver | | | | |
| 1.5.6.7 | Observe HARM delivery to target | | | | |
| 1.5.7 | PERFORM TOO HARM DELIVERY DELIVERY | Sim/Aircraft Airborne. Target detected and designated. Aircraft in vicinity of target. | | | High |
| 1.5.7.1 | Assign TDC to HARM | | TDC Sensor Control Switch | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|----------|---|------------|---|-----------------------------|----------|
| 1.5.7.2 | Select HARM mode | | LDDI - Stores Format Display | | |
| 1.5.7.3 | Select HARM TOO Mode | | DDI - HARM Display HUD - HARM TOO Format | | |
| 1.5.7.4 | Interpret display for priority target | | | HARM sensor seeker function | |
| 1.5.7.5 | Perform HARM sequencing for alternate targets | | HARM Sequence Switch on Throttle | | |
| 1.5.7.6 | Reselect priority target | | | | |
| 1.5.7.7 | Enter Class and type of target | | DDI displays and DDI buttons | | |
| 1.5.7.8 | Hand off priority target to missile | | Cage/Uncage Switch on Control Stick | | |
| 1.5.7.9 | Navigate to within range of target | | HI-HSI format | | |
| 1.5.7.10 | Acquire Aimpoint | | | | |
| 1.5.7.11 | Determine target within launch parameters | | | | |
| 1.5.7.12 | Launch HARM | | Weapons Release Switch | | |
| 1.5.7.13 | Repeat launch procedure | | | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|--|---|--|--|----------|
| 1.5.8 | PERFORM SELF PROTECT (SP)/PULLBACK (PLBK) DELIVERY | Sim/Aircraft Airborne configured with HARM. Hostile environment threat detected | | Hostile environment - active AAA and/or SAM sites | High |
| 1.5.8.1 | Recognize Self-Protect Threat | | RWR displays and tones | RWR Functions | |
| | | | L.DDI - Stores Format (HARM), SP Format | | |
| | | | HUD - SP HARM mode display | | |
| 1.5.8.2 | Sequence to other Self-Protected Targets | | HARM Sequence Switch | | |
| | | | DDI - HARM delivery display | | |
| 1.5.8.3 | Return to highest priority threats indicated on Radar Warning Receiver (RWR) | | Reset button on DDI/SP format display | | |
| 1.5.8.4 | Launch HARM | | Weapons Release button on Control Stick | | |
| 1.5.8.5 | Recognize Pullback Threat | | | | |
| 1.5.8.6 | Launch HARM | | | | |
| 1.6 | PERFORM WALLEYE DELIVERY | Sim/Aircraft Airborne. Target appropriate for Walleye. Aircraft configured with Walleye missiles, Day, VMC conditions | | Visual environment with contrast - ing targets, suitable for Walleye detection and lock-on | Low |
| 1.6.1 | SELECT OPTIONS | | L.DDI - Stores Format | | |
| 1.6.1.1 | Select Walleye I | | DDI - Walleye I format display and buttons | | |
| | | | HUD - Walleye I symbology | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|--|---|---|-------------------------|----------|
| 1.6.1.2 | Select Walleye ER/DL | | DDI - Walleye ER/DL format display | | |
| | | | HUD - Walleye ER/DL format display | | |
| | | | Master Mode Panel | | |
| 1.6.2 | TURN ON A/G MASTER MODE | | Master Arm Switch | | |
| 1.6.3 | TURN ON MASTER ARM | | TDC | | |
| 1.6.4 | PERFORM WALLEYE I DELIVERY | | Sensor Control Switch | | |
| 1.6.4.1 | Uncage Missile | | Cage/Uncage Switch on throttle | | |
| 1.6.4.2 | Acquire Target | | | | |
| 1.6.4.3 | Insure missile lock-on to target | | | | |
| 1.6.4.4 | Launch Missile | | Weapon Release Switch | | |
| 1.6.5 | PERFORM SINGLE AIRCRAFT WALLEYE ER/DL DELIVERY | Sim/Aircraft Airborne; programed for data link delivery; in range of target; configured with Walleye I, Day, VMC conditions | L.DDI - Walleye ER/DL Weapons and Pod format TDC Cage/Uncage Switch | Data Link Pod functions | Low |
| | Launch procedures same as Walleye I | | HUD - Same as for Walleye I Sensor Control Switch | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|---|---|-------------------------------|--|----------|
| 1.6.6 | PERFORM SECTION ER/DL DELIVERY | Two Sim/Aircraft Airborne; one aircraft to serve as delivery aircraft, the other as controller (pod) aircraft. In range of target | Same as above | Two aircraft functions, with programmed data link | Low |
| | Launch procedures same as Walleye I | | | | |
| | Controller aircraft guides missile after launch | | | | |
| 1.7 | PERFORM MAVERICK DELIVERY | Sim/Aircraft Airborne; in target vicinity | | Visual environment.. | Low |
| | | Maverick delivery appropriate (Laser designation) | | Laser target designation functions. Simulated Laser Spot tracker (LST) pod | |
| 1.7.1 | TURN ON A/G MASTER MODE | | Master Mode Panel | | |
| 1.7.2 | TURN ON MASTER ARM | | Master Arm Switch | | |
| | | | Sensor Control Panel | | |
| 1.7.3 | SELECT MAVERICK MISSILE | | | | |
| | | | L.DDI - Maverick Video Format | | |
| | | | R.DDI - Radar display | | |
| 1.7.4 | DESIGNATE TARGET | Laser-Detector-Tracker (LDT) capability | HUD - Maverick Display | | |
| 1.7.4.1 | Assign TDC to Maverick for scanning mode | | Sensor Control Switch | | |
| | | | TDC | | |
| 1.7.4.2 | Slave Maverick to target | | | | |
| 1.7.4.2.1 | Depress Cage/Uncage Switch | | Cage/Uncage Switch | | |
| 1.7.4.3 | Perform target lock-on | | | | |
| 1.7.4.3.1 | Depress TDC | | TDC | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|--------|--|--|---|--|----------|
| 1.7.5 | MANEUVER AIRCRAFT FOR LAUNCH CRITERIA | | | | |
| 1.7.6 | LAUNCH MAVERICK | | Weapons Release Button | | |
| 1.7.7 | REPEAT LAUNCH PROCEDURE | | | | |
| 1.8 | PERFORM STRAFING | Sim/Aircraft Airborne; target detected and designated; situation appropriate for gun | | Gun mode capability, visual environment with appropriate targets | Low |
| 1.8.1 | SELECT GUN OPTION | | L.DDI - Store management display button | | |
| 1.8.2 | SELECT MODE OF OPERATION, CCIP OR MANUAL | | L.DDI - Mode Button HUD - CCIP or Manual mode gun display | | |
| 1.8.3 | MANEUVER AIRCRAFT TO POSITION RETICLE ON TARGET | | HUD - Gun display | | |
| 1.8.4 | FIRE GUN | | Trigger Switch on Control Stick | | |
| 1.8.5 | PERFORM BREAKAWAY/PULLUP MANEUVER | | HUD - Gun Display | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|---|--|---|--|----------|
| 2.0 | PERFORM AIR-TO-AIR TACTICS | Sim/Aircraft mission ready aircraft armed with AIM-7, AIM-9 and Gun. Single/multi plane flight | | A/A visual/radar environment, maneuvering targets, Mission Computer functions, aircraft flight dynamics, Stores Management set functions | High |
| 2.1 | PERFORM PRE-A/A COMBAT CHECKS | | | | |
| 2.1.1 | SET-UP COCKPIT FOR A/A WEAPONS DELIVERY | | | | |
| 2.1.1.1 | Turn on radar | | Sensor control panel - Radar Switch | | |
| 2.1.1.2 | Turn on A/A Master Mode | | A/A Master Mode Switch or A/A Weapon Select Switch on Control Stick | | |
| 2.1.1.3 | Perform missile checks | Sim/Aircraft armed with AIM-7 and AIM-9 missiles | R-DDI - Radar display for selected weapons L-DDI - Stores format | | |
| 2.1.1.4 | Set up ECM Equipment | Sim/Aircraft ECM equipment installed | Sensor Control Panel with switches | ALO-1268 Countermeasure Set Functions | |
| 2.1.1.5 | Check radar for A/A mission | | R-DDI - Radar Display modes Radar Push button controls or TDC | A/A Radar Environment | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|-----------------------------------|--|--|--|----------|
| 2.1.1.6 | Set up data link | Sim/Aircraft with standard data link equipment installed | | Ground or air data link capability | Low |
| 2.2 | PERFORM MEDIUM RANGE INTERCEPT | | | | High |
| 2.2.1 | PERFORM A/A TARGET SEARCH | Sim/Aircraft Airborne; medium range targets available | HUD - Navigation displays R.DDI - Radar displays | A/A environment | High |
| 2.2.1.1 | Operate radar in search | A/A environment; operable A/A radar | Sensor control switch TDC | A/A radar environment with maneuvering targets | |
| 2.2.1.1.1 | Select radar modes | | R.DDI - Radar Modes Displays - RWS, VS, TWS, ACM, GACO, STT RAID, AACQ, NCTR, ECCM | A/A Radar Capability | |
| 2.2.1.1.2 | Change Channels | Various threat situations require change in radar channel | R.DDI - Push button | | |
| 2.2.1.1.3 | Select silent options | Various threat situations; tactical situations; requires use of silent options | R.DDI - Push Button TDC | Maneuvering Targets | Low |
| 2.2.2 | INTERPRET SEARCH DISPLAYS | Sparrow/Sidewinder search display on DDI | R.DDI - Radar search display HUD | | High |
| 2.2.2.1 | Identify cues/symbology in search | | R.DDI HUD | | |
| 2.2.2.2 | Identify targets | | R.DDI HUD | A/A environment, maneuvering targets | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|----------------------------------|---|------------------------------|-------------------------------|----------|
| 2.2.3 | PERFORM RADAR TARGET ACQUISITION | Sim/Aircraft Airborne; targets within range | R.DDI - Radar Display HUD | | High |
| 2.2.3.1 | Interpret track display | | | | |
| 2.2.3.2 | Perform target lock-on | | | | |
| 2.2.3.3 | Respond to acquisition track | | | | |
| 2.2.4 | FLY INTERCEPT PROFILE | | | | High |
| 2.2.4.1 | Perform intercept approach phase | | R.DDI - Radar Display HUD | Air-to-air threat environment | |
| 2.2.4.1.1 | Select tactics | | | | |
| 2.2.4.1.2 | Turn on Master Arm | | Master Arm switch | | |
| 2.2.4.2 | Perform intercept attack phase | Radar lock-on and tracking target | | | High |
| 2.2.4.2.1 | Select intercept tactics | | | | |
| 2.2.4.2.2 | Perform head-on attack | Head-on aspect | | | |
| 2.2.4.2.3 | Perform head-on reattack | Situation appropriate for reattack | | | |
| 2.2.4.2.4 | Perform forward quarter attack | Radar locked-on and tracking; forward quarter aspect. | | | |
| 2.2.4.2.5 | Perform forward quarter reattack | Situation appropriate for reattack | | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|------------|--------------------------------|--|---|---|----------|
| 2.2.4.2.6 | Perform beam attack | Beam Aspect | | | |
| 2.2.4.2.7 | Perform beam attack reattack | Situation appropriate for beam reattack | | | |
| 2.2.4.2.8 | Perform rear quarter attack | Tracking target in rear quarter | | | |
| 2.2.4.2.9 | Perform stern attack | Tracking target in stern quadrant | | | |
| 2.2.4.2.10 | Perform VID | Requirement exists for visual identification of target | | Target in visual environment | |
| 2.2.4.2.11 | Perform data link intercept | Data link pod installed and operational | | Data link pod functions | Low |
| 2.3 | PERFORM A/A WEAPONS DELIVERY | | | | |
| 2.3.1 | PERFORM AIM-7 (SPARROW) LAUNCH | Sim/Aircraft Airborne; target acquired on radar or visually; target confirmed as threat; aircraft configured with AIM-7 missiles | | Visual air-to-air environment with threat aircraft 2-3 miles visibility | High |
| 2.3.1.1 | Set up weapon system | | | | |
| 2.3.1.1.1 | Select AIM-7 missile | | Weapon Select Switch - on control stick | SMS functions | |
| | | | L.DDI - AIM-7 display | MC functions | |
| | | | R.DDI - Radar display | | |
| 2.3.1.1.2 | Acquire target | | HUD - Sparrow Format, Steering Displays | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|--|------------------------------|--|--|----------|
| 2.3.1.1.3 | Follow steering dot on HUD | Target within missile range | | | |
| 2.3.1.2 | Perform final attack steering | | HUD - Steering display R.DDI - Radar display (STT) | | |
| 2.3.1.2.1 | Verify target parameters (range, velocity) | No radar jamming encountered | HUD - SHOOT display | | |
| 2.3.1.3 | Initiate AIM-7 missile launch | | Trigger - on control stick SHOOT cue on HUD and DDI display | Targets in air-to-air environment | High |
| 2.3.1.3.1 | Turn on Master Arm Switch | | Master Arm Switch | | |
| 2.3.1.3.2 | Verify launch parameters | | HUD - Display R.DDI - Radar display - STT mode | | |
| 2.3.1.3.3 | Identify cockpit cues for in-envelope verification. SHOOT cue on | | | | |
| 2.3.1.3.4 | Launch AIM-7 | | Trigger switch | | |
| 2.3.1.3.5 | Maintain post-launch guidance | | | | |
| 2.3.1.3.6 | Sequence to next weapon | | Weapon Select Switch | | |
| 2.3.1.4 | Assess weapon effects | | | Hit, miss distance Missile in range, etc. | Medium |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-------------|------------------------------------|---|--|---|----------|
| 2.3.2 | PERFORM AIM-9 (SIDEWINDER) LAUNCH | Sim/Aircraft airborne; final phase of Sidewinder attack; VMC; aircraft configured with AIM-9 missiles | | Visual air-to-air environment target aircraft emitting IR energy | High |
| 2.3.2.1 | Set up weapon system | | | | |
| 2.3.2.1.1 | Select AIM-9 missile | | Weapon Select Switch L.DDI-AIM-9 Stores Format R.DDI-Radar displays HUD-Steering displays | | |
| 2.3.2.1.2 | Turn on Master Arm Switch | | Master Arm Switch | | |
| 2.3.2.2. | Perform seeker head/target lock-on | | | | |
| 2.3.2.2.1 | Perform radar slaved lock-on | | R.DDI - Radar Displays HUD - Steering displays | Aural tone indication - AIM-9 missile | |
| 2.3.2.2.1.1 | Identify aural indications | | Aural tones - AIM-9 | AIM-9 audio tone capability | |
| 2.3.2.2.2 | Perform boresight lock-on | | R.DDI - Boresight display HUD - Steering displays Cage/Uncage Switch (Boresight lock-on) | | |
| 2.3.2.2.2.1 | Identify aural indications | | | | |
| 2.3.2.2.3 | Verify in-envelope flight | | | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|-------------------------------------|--|---|---|----------|
| 2.3.2.3.1 | Fly steering dot to maintain target | | HUD display | | |
| 2.3.2.4 | Initiate AIM-9 launch | | Trigger - on control switch | Targets in air-to-air environment | High |
| 2.3.2.4.1 | Sequence to next weapon | | | | |
| 2.3.2.5 | Assess weapon effects | | | Hit, miss distance, missile in range | Medium |
| 2.3.3 | PERFORM GUN ATTACK | | | | |
| | | Sim/Aircraft Airborne; close visual contact with enemy aircraft; gun capable | | Visual air-to-air environment with enemy aircraft targets | Low |
| 2.3.3.1 | Set up weapon system | | Weapon Select Switch | | |
| | | Full range of gun options available | HUD - Gun display | | |
| | | | L.DDI - Stores Format display | | |
| | | | R.DDI - Radar display | | |
| 2.3.3.1.1 | Select alternate gun modes | | L.DDI - Gun mode options | | |
| | | | Weapon Select Switch | | |
| 2.3.3.1.2 | Master Arm Switch to ARM | | Master Arm Switch | | |
| 2.3.3.2 | Track target | | Cage/Uncage Switch | | |
| | | | HUD - Reticle displays, based on mode selection | | |
| | | | R.DDI - Radar displays (RWS mode) | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|-----------------------|--|------------------------------|--------------------------|----------|
| 2.3.3.3 | Activate gun | Sim/Aircraft configured with 20 mm gun | Trigger on control stick | | |
| 2.3.3.4 | Assess weapon effects | | | Hit and/or miss distance | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|-------------------------------------|--|---|----------------------------------|----------|
| 3.0 | PERFORM DEFENSIVE TACTICS | Sim/Aircraft equipped with ECM/ECM equipment; with/without HARM | | AA/AAA/SAM threat environment | High |
| | Reference: A1-F18AC-NFM-100/(C) | | | ALQ-126B Countermeasures Set | |
| | Supplemental NATOPS | | | Functions | |
| | | | | ALR-67 Radar Warning Receiver | |
| | | | | Functions | |
| | | | | ALE-39 Countermeasures | |
| | | | | Dispensing Set | |
| | | | | Command Launch Computer Function | |
| 3.1 | SET UP ECM EQUIPMENT | Sim/Aircraft equipped with ALQ-126B Electronic Countermeasures (ECM) set | | | High |
| 3.1.1 | SET UP STAND BY MODE | | Dispenser/ECM Control Panel, ECM Mode Knob, Stand-by light | | |
| 3.1.2 | SET UP RECEIVE MODE | | ECM Mode Knob Receive Light Communications Panel | | |
| 3.1.3 | SET UP REPEAT/TRANSIT MODE | | ECM Mode Knob ECM Warning Lights | Threat radar environment | |
| 3.1.4 | SET UP RADAR WARNING RECEIVER (RWR) | Sim/Aircraft equipped with ALR-67 RWR equipment | Control Indicator Azimuth Indicators | RWR Capability | High |
| 3.1.4.1 | Turn on power | | Power Button | | |
| 3.1.4.2 | Check audio volume | | Audio Control Headset | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|--|--|--|---|----------|
| 3.1.4.3 | Check threat warning lights | | Warning/ Caution Advisory Panel | | |
| 3.1.5 | SET UP DISPENSER | Sim/Aircraft equipped with ALE-39 Countermeasures dispensing set | | ALE-39 dispensing set capabilities | High |
| 3.1.5.1 | Select options | Chaff, flare, jammer equipment | Dispenser/ECM Control Panel | | |
| 3.1.5.2.1 | Select desired decoy | | Payload Select Knob | | |
| 3.1.5.2.2 | Select Mode | | Mode Switch | | |
| 3.2 | COUNTER THREATS | Sim/Aircraft airborne; visual and aural threats received | | | High |
| 3.2.1 | IDENTIFY THREATS VIA COCKPIT VISUAL CUES | Visual AA threat cues received | | Visual AA threat environment | |
| 3.2.1.1 | Identify bomber threats | Sim/Aircraft Airborne; bomber threat received | DDI - Radar Displays | Visual/Radar air-to-air environment with bomber threats | |
| 3.2.1.2 | Identify fighter attack threats | Sim/Aircraft airborne; fighter attack threats received | DDI - Radar Displays | Enemy fighter attack environment | |
| 3.2.1.3 | Identify air-to-air missile threats | Sim/Aircraft airborne; incoming A/A missiles threat received | DDI - Radar Displays RWR - Display and aural indications | Enemy A/A missile environment | |
| 3.2.1.4 | Identify land based surface-to-air threats | Sim/Aircraft Airborne; AAA/SAM visual cockpit threat received | DDI - Radar Displays RWR - Threat displays, aural indications | AAA/SAM threat environment | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------|--|---|--|---|----------|
| 3.2.1.5 | Identify naval surface-to-air threats | Sim/Aircraft Airborne; surface ship to air missile threat cues received | DDI - Radar Displays RWR - Threat Displays; aural indications | Surface to air missile environment | |
| 3.2.2 | IDENTIFY THREATS VIA AURAL CUES | | | | |
| | | Sim/Aircraft Airborne; aural AA threat cues | RWR - Threat displays aural tone indications | Aural threat environment | |
| 3.2.2.1 | Identify bomber threats | AA aural threats received | DDI - Radar Displays RWR - Aural indications | AA aural threat environment | |
| 3.2.2.2 | Identify fighter attack threats | Enemy fighter attack aural cues received | DDI - Radar Displays RWR - Aural indications | Enemy fighter attack environment | |
| 3.2.2.3 | Identify air-to-air missile threats | Incoming A/A aural threat cues received | DDI - Radar Displays RWR - Aural indications | Enemy A/A missile environment | |
| 3.2.2.4 | Identify land based surface-to-air threats | AAA/SAM aural threat cues received | DDI - Radar Displays RWR - Aural indications | AAA/SAM threat environment | |
| 3.2.2.5 | Identify Naval surface-to-air threats | Surface ship to air missile threat cues received | DDI - Radar Displays RWR - Aural indications | Surface to air missile threat environment | |
| 3.2.3 | IDENTIFY THREATS VIA EXTERNAL CUES | A/A threats cues received | | A/A visual threat environment | |
| 3.2.3.1 | Identify bomber threats | Sim/Aircraft Airborne; bomber threats sighted | | Bomber aircraft in visual environment | |
| 3.2.3.2 | Identify fighter attack threats | Sim/Aircraft Airborne; fighter attack threats visually sighted | | Fighter attack aircraft in visual environment | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-----------|--|--|---|--|----------|
| 3.2.3.3 | Identify air-to-air missile threats | Sim/Aircraft Airborne; A/A missile threats visually sighted | | Incoming A/A missiles threat visual environment | |
| 3.2.3.4 | Identify land based surface-to-air threats | AAA/SAM threat cues visually received | | AAA/SAM visual threat environment | |
| 3.2.3.5 | Identify Naval surface-to-air threats | Naval Surface-to-air threats visually received | | Naval ship with visual missile threat environment | |
| 3.2.4 | RESPOND TO AIR-TO-AIR THREAT | Threat identified target in sight if possible | | Air-to-Air missile threat environment | High |
| 3.2.4.1 | Select counter tactics | Sim/Aircraft Airborne; visual and aural threats received | DDI - Radar Display RWR - Aural tone threat indications | | |
| 3.2.4.2 | Counter IR Missile threat | Sim/Aircraft Airborne; equipped with ALQ-126B Electronic Countermeasures equipment; ALE-39 Dispensing Set; ALR-67, RWR equipment | | ECM/ECCM capability | |
| 3.2.4.2.1 | Perform defensive maneuvers | IR missile threat identified; visual and aural cues received | | Air-to-Air visual environment with missile threats | |
| 3.2.4.2.2 | Perform ECM | IR missile threat identified; visual and aural cues received; ECM equipment operable | Dispenser/ECM Control Panel RWR Indicator ECM Warning Light | ECM, ECCM capability | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-------------|-------------------------------------|---|---|--|----------|
| 3.2.4.2.2.1 | Dispense Chaff/Flares | IR missile threat identified; missile in sight if possible; aircraft equipped with chaff/flares | Dispense/ECM Control Panel Master Arm Switch Flare/Chaff Dispense Switch on Throttle | IR missile environment visual air-to-air environment chaff/ flare capability | |
| 3.2.4.3 | Counter radar guided missile threat | Visual and aural threat cues received | Control Indicator Azimuth Indicator RWR DDI - Radar Display | Radar guided missile threat environment | High |
| 3.2.4.3.1 | Perform defensive maneuvers | Radar guided missile threat identified; visual and aural threat cues received | Dispenser/ECM Control Panel RWR - with aural indicators ECM warning lights | Visual air-to-air environment with missile threats | |
| 3.2.4.3.2 | Perform ECM | ECM equipment operable | | ECM, ECCM capability | |
| 3.2.4.3.2.1 | Dispense Chaff/Flares | Sim/Aircraft equipped with Chaff/Flares | Dispenser/ECM Control Panel Master Arm Switch Flare/Chaff Dispense Switch on throttle | Chaff/Flare capability | |
| 3.2.4.4 | Counter gun threat | Sim/Aircraft Airborne; visual threat cues received; aircraft equipped with 20MM gun | | Threat aircraft in air-to-air environment | Medium |
| 3.2.4.4.1 | Perform defensive maneuvers | Gun threat identified; visual and aural threat cues received | | Visual air-to-air ACM environment | |
| 3.2.4.4.2 | Perform ECM | Threat identified; aircraft equipped with ECM equipment | Control Indicator, Azimuth Ind RWR DDI - Radar Display | ECM, ECCM Capability | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|-------------|---|--|--|--|----------|
| 3.2.4.4.2.1 | Dispense Chaff/Flares | Sim/Aircraft equipped with Chaff/Flares | Dispenser/ECM Control Panel Master Arm Switch Flare/Chaff Dispense Switch on throttle | Chaff/Flare capability | |
| 3.2.5 | COUNTER AAA THREAT | Sim/Aircraft Airborne; visual and aural threat cues received from land-based and/or shipboard AAA sites | | Land-based and/or shipboard AAA threat sites in geographic environment | High |
| 3.2.5.1 | Identify AAA threat | Sim/Aircraft Airborne; equipped with ALQ-126B Electronic Countermeasures equipment; ALE-39 Dispensing Set; ALR-67 RWR equipment | DDI - Radar Display RWR - Visual and aural warning indications | ECM/ECCH capability | |
| 3.2.5.1.1 | Identify threat via cockpit visual cues | AAA threats received | DDI - Radar Display RWR - Visual AAA indications | | |
| 3.2.5.1.2 | Identify threat via cockpit aural cues | AAA threats received | RWR - Aural AAA indications pilot headset | | |
| 3.2.5.1.3 | Identify threat via external visual cues | AAA threats received | | Visual AAA threat environment | |
| 3.2.5.2 | Respond to AAA threat | Sim/Aircraft Airborne; visual and aural threat cues received from land based and/or shipboard AAA sites | | | High |
| 3.2.5.2.1 | Select counter tactics | | | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------------|--|---|--|-------------------------|----------|
| 3.2.5.2.2 | Perform counter to AAA threat | Sim/Aircraft Airborne; AAA threat determined; site/tracer in sight; visual and aural threat cues received from AAA sites. | | | |
| 3.2.5.2.2.1 | Perform defensive maneuvering | Evasive aircraft maneuvers | | Visual AAA environment | |
| 3.2.5.2.2.2 | Perform ECM | AAA threat received; visual and aural threat cues received; ECM equipment operable | DDI - Radar Display RWR - Visual and Aural threat indications Control Indicator Azimuth Indicator | | |
| 3.2.5.2.2.2.1 | Dispense Chaff/Flares | Sim/Aircraft equipped with Chaff/Flare equipment | Flare/Chaff Switch on throttle Dispense button on ECM Control Panel. ECM Dispense Button Under left Canopy. Dispenser/ ECM Control Panel. Master Arm Switch | AAA Visual environment | |
| 3.2.5.2.3 | Assess results of counter to AAA threat | | | | |
| 3.2.6 | COUNTER SURFACE-TO-AIR MISSILE (SAM) THREATS | Sim/Aircraft Airborne; visual and aural SAM threat cues received | | SAM threat environment | High |
| 3.2.6.1 | Identify SAM threats | Sim/Aircraft Airborne; equipped with ALQ-126B Electronic Countermeasure equipment; ALE-39 Dispensing Set; ALR-67, RWR equipment | DDI - Radar Display RWR - Visual and Aural indications | ECM/ECM capability | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------------|--|---|---|-------------------------------|----------|
| 3.2.6.1.1 | Identify SAM threat via cockpit visual cues | SAM threats received | DDI - Radar Display RWR - Visual Indications | SAM threat environment | |
| 3.2.6.1.2 | Identify SAM threat via cockpit aural cues | Sim/Aircraft Airborne; aural SAM threat cues received | RWR - Aural indications Pilot Headset | | |
| 3.2.6.1.3 | Identify SAM threat via external visual cues | Sim/Aircraft Airborne; visual SAM threat cues received; SAM threat in sight | | Visual SAM threat environment | |
| 3.2.6.2 | Respond to SAM threat | Sim/Aircraft Airborne; in threat environment with visual and/or aural SAM threat cues received | | | |
| 3.2.6.2.1 | Select Counter tactics | | | | |
| 3.2.6.2.2 | Perform Counter to SAM threat | Sim/Aircraft Airborne; SAM threat in sight or direction/proximity identified by visual and aural SAM threat cues. | DDI - Radar Display RWR - Visual and aural indications | Visual SAM threat environment | |
| 3.2.6.2.2.1 | Perform aircraft maneuvering | Evasive aircraft maneuvers | | | |
| 3.2.6.2.2.2 | Perform ECM | SAM threat identified; visual and aural cues received; ECM equipment operable | DDI - Radar Display RWR - Visual and aural indications Control Indicator Azimuth Indicator | | |
| 3.2.6.2.2.2.1 | Dispense Chaff/Flares | Sim/Aircraft Airborne; equipped with Chaff/Flare equipment | Flare/Chaff Switch on throttle Dispenser/ECM Control Panel Master Arm Switch | | |

| NUMBER | TASK | CONDITIONS | CONTROLS/DISPLAYS/INDICATORS | SIMULATION REQUIREMENTS | PRIORITY |
|---------------|---|--|--|-------------------------|----------|
| 3.2.6.2.2.3 | Perform HARM delivery | Sim/Aircraft Airborne; equipped with operational HARM missiles | DDI - HARM display HUD - HARM display | SAM site environment | High |
| 3.2.6.2.2.3.1 | Perform Self Protect/Pullback HARM delivery | | | | |
| | See task: 1.5.8 | | | | |
| 3.2.6.2.2.4 | Assess results of counter to SAM threat | | | | |